01 ON BOARD DIAGNOSTIC (OBD)

ON BOARD DIAGNOSTIC (OBD)

On Board Diagnostic (OBD), technical data

Equipment

- Data is transmitted between the control module and the VAS5051 tester via operating mode "On Board Diagnostic (OBD)".
- DTC memory is designed for permanent memory and is therefore not dependent on voltage supply.
- Display of stored DTCs occurs after initiation of display mode. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- DTC memory must be erased after malfunction is repaired. Refer to **Diagnostic Trouble Code (DTC) memory, erasing**.

Important:

- Readiness code must be generated every time DTC memory is erased. Refer to **Readiness code, generating** .
- If the ECM recognizes malfunctions that lead to a worsening of emissions values, it indicates them by lighting the Malfunction Indicator Lamp (MIL) -K83- in the instrument cluster. Meaning of exhaust Malfunction Indicator Lamp (MIL) -K83-. Refer to **Exhaust Malfunction Indicator Lamp (MIL) in instrument cluster**.
- EPC relevant malfunctions are also indicated by the Electronic Power Control (EPC) warning lamp in the instrument cluster.

Exhaust Malfunction Indicator Lamp (MIL) in instrument cluster

If the ECM recognizes malfunctions that lead to a worsening of emissions values, it indicates them by lighting the exhaust Malfunction Indicator Lamp (MIL).

The Engine Control Module (ECM) switches on the exhaust Malfunction Indicator Lamp (MIL) after ignition is switched on. Shortly after engine is started, the exhaust MIL will go out. This requires, first of all, that the Engine Control Module (ECM) does not detect a malfunction that worsens the emissions values and, secondly, that activation of the lamp by the Engine Control Module (ECM) is OK.

If malfunctions that worsen emissions are recognized during operation of the engine, the ECM switches on the exhaust MIL in instrument cluster. An entry is made in DTC memory at the same time.

The Malfunction Indicator Lamp (MIL) can blink or remain lit continuously. DTC memory should be checked in either case. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .

Continuously lit:

There is a malfunction that causes increased emissions. Check DTC memory for Motronic ECM and automatic transmission (if installed).

Check DTC memory if there is a drivability problem or a customer complaint, but the exhaust Malfunction Indicator Lamp (MIL) is not lit. There may be DTCs stored that do not cause the exhaust MIL to light up immediately, but only after engine is started again and malfunction is recognized again.

Blinking:

There is a malfunction that causes damage to the catalytic converter in this driving condition (e.g. combustion misfire). In this case, vehicle must only be driven at reduced power!

Exhaust Malfunction Indicator Lamp (MIL), checking

Function test of warning lamp

- ○ Switch ignition on.
- Warning lamp for On Board Diagnostic (Malfunction Indicator Lamp -MIL-) must light up
- ○ Start engine.
- Shortly after engine is started, the Malfunction Indicator Lamp (MIL) will go out if there are no malfunctions stored in the DTC memory that relate to the emissions system

NOTE: **The switch-on signal for the Malfunction Indicator Lamp (MIL) is transferred from the Engine Control Module (ECM) to the instrument cluster via CAN-bus. Check data exchange between the Engine Control Module (ECM) and other CAN capable control modules. Refer to Data exchange between engine control module and other CAN-control modules, checking**

Safety precautions

NOTE: **The following points if testers and measuring instruments have to be used during a road test:**

WARNING:

- **Always install testers and measuring instruments on the back seat and have a second person operate them from there.**
- **If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.**

Vehicle diagnostic, testing and information system VAS5051, connecting and select functions

Test requirements

- Fuses for engine electronics OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Battery voltage at least 12.7 V
- Ground connections on engine and transmission OK.

Procedure

- Switch ignition off.

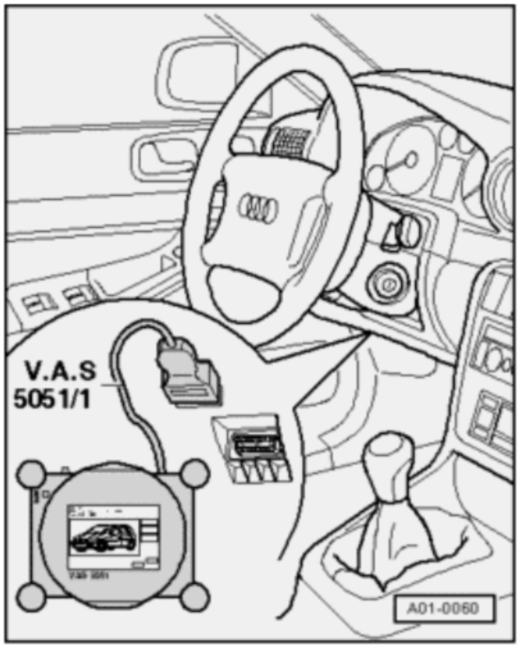

Fig. 1: Identifying Vehicle Diagnosis, Testing and Information System VAS 5051 and Data Link Connector (DLC)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect up vehicle diagnostic, testing and information system VAS5051 with diagnostic wire VAS5051/1.

WARNING: **Note the safety precautions. Refer to Safety precautions**

NOTE: **A DTC message appears on the display:**

Refer to Operating instructions of vehicle diagnostic, testing and information system VAS5051

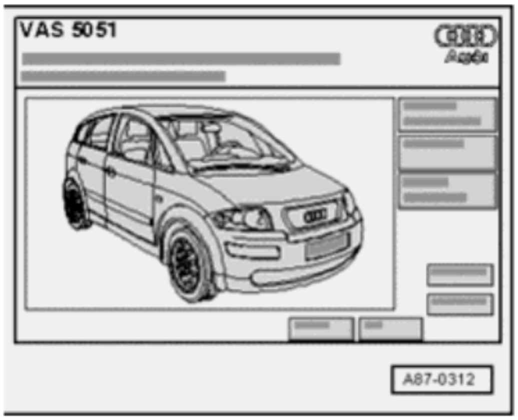

Fig. 2: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Press "vehicle self-diagnosis" button.

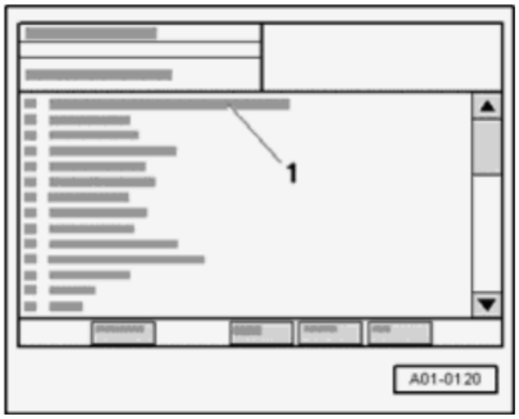

Fig. 3: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

NOTE: **The automatic test sequence is carried out by pressing "00 - Check Diagnostic Trouble Code (DTC) memory - Total system" in selection -1-, i.e. the DTC memories of all vehicle systems with On Board Diagnostic (OBD) capability are checked.**

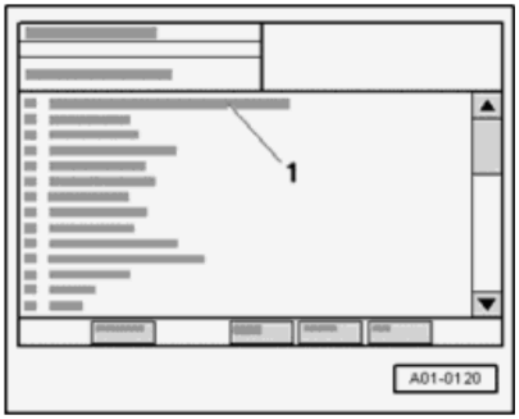

Fig. 4: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

Depending on which function is required "Diagnostic functions" table: Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** :

- Switch ignition on.

or

- Start engine.
- Select vehicle system "01 - Engine electronics" in selection -1-.
- Wait until next display appears.

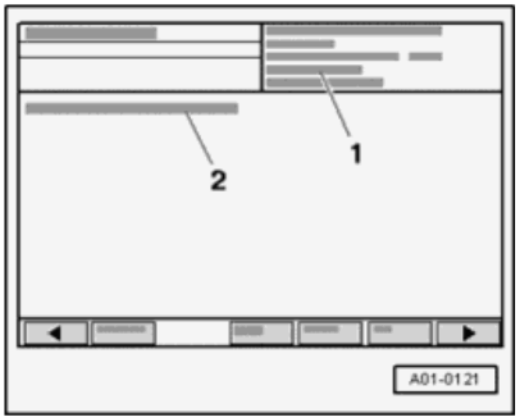

Fig. 5: VAS 5051 Tester Displaying Control Module Identification And Coding
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Control module identification of engine control module. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions**

2 - Control module identification of immobilizer. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions**

Control module identification Engine control module (example)		
01 - Engine electronics	Vehicle system	
8E0909559..	Part-No.; assignment	
3.0 liter 1) V6/5 V 2) G 3) 0003 4)	1) 2) 3) 4)	Engine capacity Engine, 6-cylinder/5-valve) • G = cruise control system activated • No display = no cruise control system or cruise control system not activated Control module data status (software type)
Code 16751:	Code of control module (check. Refer to **Control module, coding**)	
Dealership No. 12345	Workshop code of VAS5051 with which coding was last performed	

Control module identification, immobilizer (example)		
WAUXXX8EX2A054321 1) AUZ7Z0X1137197 2)	1) 2)	17-digit vehicle identification no. (VIN) 14-digit ident no. for immobilizer

- Press delta button.

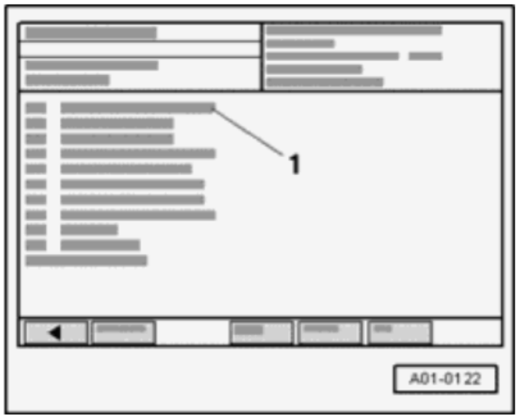

Fig. 6: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Selection of diagnostic functions:

Diagnostic functions		Ignition on, Engine stopped	Engine idling	Vehicle running	Refer to
02	Checking Diagnostic Trouble Code (DTC) memory	No	Yes	Yes	Refer to **Diagnostic Trouble Code (DTC) memory, checking**
03	Final control diagnosis	Yes	No	No	Refer to **Output Diagnostic Test Mode (DTM)**
04	Basic setting	No	Yes	No	Refer to **Basic setting**
05	Erasing DTC memory	Yes	Yes	Yes	Refer to **Diagnostic Trouble Code (DTC) memory, checking**
06	End of output	Yes	Yes	Yes	Refer to **Ending output**
07	Coding control module	Yes	No	No	Refer to **Control module, coding**
08	Reading measured value block	Yes	Yes	Yes	Refer to **Measured value block, reading**
09	Reading individual measured value	No	No	No	-
10	Adaptation	No	Yes	No	Refer to **Adaptation**
11	Coding II	Yes	No	No	Refer to **Login procedure or coding II**

DIAGNOSTIC TROUBLE CODE (DTC) MEMORY

Diagnostic Trouble Code (DTC) memory, checking

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine should be idling.

NOTE: **If the engine will not start, crank it for at least 5 seconds with the starter and leave the ignition on.**

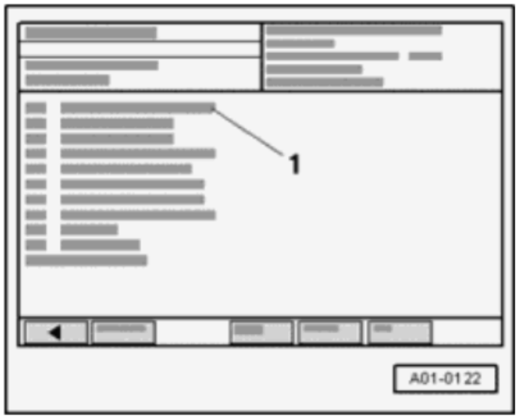

Fig. 7: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "02 - check DTC memory".

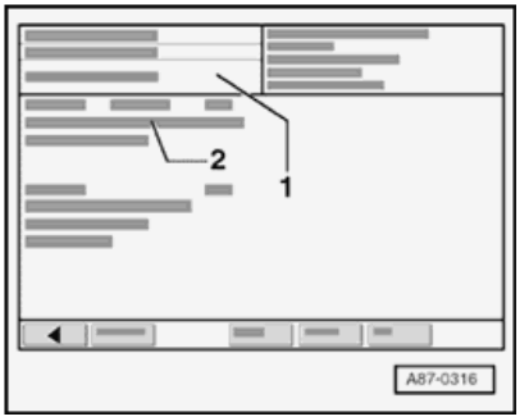

Fig. 8: Identifying Content Of DTC Memory & Identification Of Fault On Diagnostic System VAS 5051 Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Contents of DTC memory

0 Faults recognized

or

X Faults recognized

2 - Fault

Fault code

Fault location

Fault type

A - If malfunctions were recognized:

- Print out screen content or On Board Diagnostic (OBD) report.
- Exit function "02 - check DTC memory" by pressing <-- button.

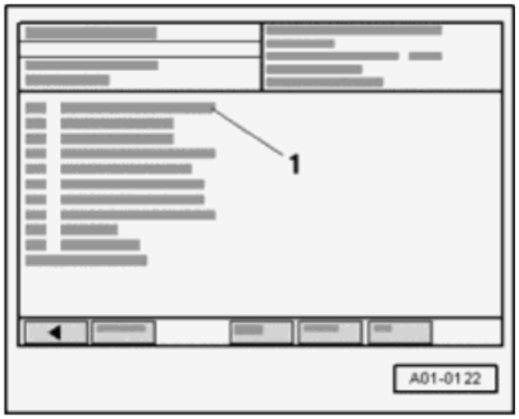

Fig. 9: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Repair DTC(s) as specified in DTC table. Refer to **Diagnostic Trouble Code (DTC) table**.
- Reselect diagnostic function "02 - Check DTC memory" and erase the DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, erasing**.
- Select diagnostic function "06 - End output" in selection. Refer to **Ending output**.

B - If no malfunction was recognized:

- Select diagnostic function "06 - End output" in selection. Refer to **Ending output**.

Diagnostic Trouble Code (DTC) memory, erasing

NOTE: If it is not possible to erase DTC memory, check it once again and remedy malfunctions.

Requirements

- DTC memory checked. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- All malfunctions repaired.

After DTC memory has been successfully checked:

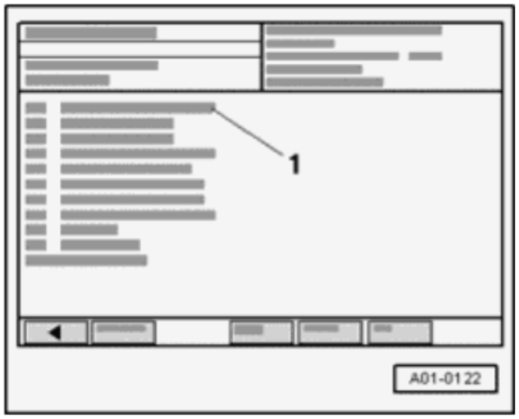

Fig. 10: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "05 - Erase DTC memory".

Fig. 11: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

No display (before erasing)

or

DTC memory erased

NOTE: **The following message appears in display zone -1-: "DTC memory not yet checked", if the operational sequence was not adhered to exactly. If the DTC memory has been checked beforehand, the DTC memory can only be erased.**

NOTE: **Should the function be carried out?**

Will be erased!

- Press "OK" button in display -2-.
- Exit function "05 - Erase DTC memory" by pressing <-- button.
- Check DTC memory again after repair work and erase it if necessary.

NOTE: **This erases DTCs that have been stored while the malfunction was being fixed, for example, malfunctions that have arisen as a result of connectors being detached.**

Ending output

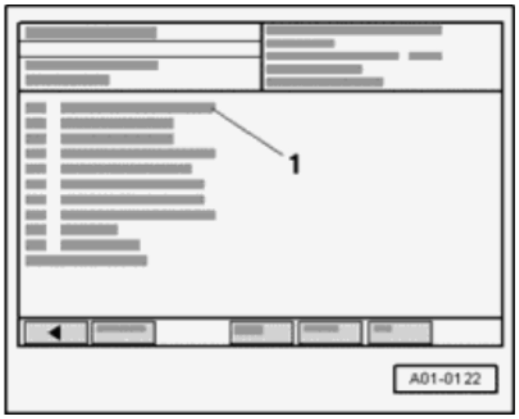

Fig. 12: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "06 - End output".

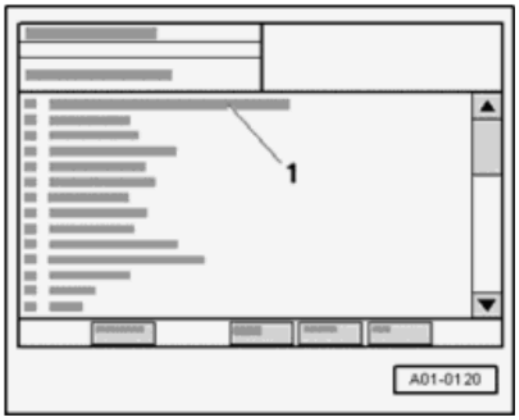

Fig. 13: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Switch ignition off when this display appears and disconnect diagnostic connector.

Diagnostic Trouble Code (DTC) table

NOTE:

- **If malfunctions occur in the monitored sensors and components, these are stored in the DTC memory together with an indication of type of malfunction.**
- **Malfunctions related to EPC are additionally indicated by the warning lamp for the electronic throttle control ("EPC warning lamp") which is situated in the instrument cluster. Notes on EPC system. Refer to Function of the electronic throttle system.**
- **Malfunctions that worsen emissions are indicated by an exhaust warning lamp (MIL) that is also located in the instrument cluster. There are malfunctions that cause the exhaust warning lamp to light up immediately after recognition. Malfunctions can also occur that cause the exhaust MIL to light up, but only if malfunction is recognized again after repeated engine starts. Notes for exhaust warning lamp (MIL). Refer to Exhaust Malfunction Indicator Lamp (MIL) in instrument cluster.**
- **The DTC table is sorted according to the 5-digit DTC code on the left.**
- **Sporadic malfunctions (malfunction occurring from time to time) are indicated as "sporadic" on the display. The word "sporadic" signifies individually occurring, random malfunctions.**
- **Do not immediately replace components indicated as faulty by the VAS5051 but: first check the wiring and connectors of these components against the wiring diagram. Check the Ground connections against wiring diagram. This is particularly relevant for malfunctions recorded as "sporadic".**
- **After erasing the DTC memory. Refer to Diagnostic Trouble Code (DTC) memory, checking the readiness code must be regenerated. Refer to Readiness code, generating.**

DTCs P0010 to P1130, VAG 16394 to 17538

DTC code		DTC text	Corrective action
SAE	VAG		
P0010	16394	Camshaft position actuator circuit, Bank 1 Malfunction	Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
P0011	16395	Retarded camshaft adjustment, Bank 1 Specification not achieved	
P0012	16396	Advanced camshaft adjustment, Bank 1	

		Specification not achieved	
P0014	16398	Retarded camshaft adjustment, exhaust, Bank 1 Specification not achieved	
P0015	16399	Advanced camshaft adjustment, exhaust, Bank 1 Specification not achieved	
P0020	16404	Camshaft position actuator circuit, Bank 2 Malfunction	

NOTE:

- **Diagnosis of the camshaft adjustment is influenced by the oil temperature sensor. If the DTC P0196/16580 "Engine Oil Temperature Sensor -G8-, Incorrect signal" is also stored, first check the sensor.**
- **In the case of camshaft adjustment malfunctions, check the oil pressure of the engine.**

Refer to **17 ENGINE - LUBRICATION**

- An entry in the DTC memory may also be made due to mechanical problems: running-in process not yet complete (friction), seized camshaft (perform visual check of camshaft bearings).

DTC code		DTC text	Corrective action
SAE	VAG		
P0021	16405	Retarded camshaft adjustment, Bank 2 Specification not achieved	Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
P0022	16406	Advanced camshaft adjustment, Bank 2 Specification not achieved	
P0023	16407	Camshaft adjustment, exhaust, Bank 2 Malfunction	
P0024	16408	Retarded camshaft adjustment, exhaust, Bank 2 Specification not achieved	

P0025	16409	Advanced camshaft adjustment, exhaust, Bank 2 Specification not achieved	
P0030	16414	O2 sensor heater circuit, Bank 1, Sensor 1 Open circuit	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
P0031	16415	O2 sensor heater circuit, Bank 1, Sensor 1 Short to Ground	
P0032	16416	O2 sensor heater circuit, Bank 1, Sensor 1 Short to positive (B+)	

NOTE:

- **Diagnosis of the camshaft adjustment is influenced by the oil temperature sensor. If the DTC P0196/16580 "Engine oil temperature sensor -G8-, Incorrect signal" is also stored, first check the sensor.**
- **In the case of camshaft adjustment malfunctions, check the oil pressure of the engine.**

Refer to **17 ENGINE - LUBRICATION**

- An entry in the DTC memory may also be made due to mechanical problems: running-in process not yet complete (friction), seized camshaft (perform visual check of camshaft bearings).

DTC code		DTC text	Corrective action
SAE	VAG		
P0036	16420	O2 sensor heater circuit, Bank 1, Sensor 2 Open circuit	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
P0037	16421	O2 sensor heater circuit, Bank 1, Sensor 2 Short to Ground	

P0038	16422	O2 sensor heater circuit, Bank 1, Sensor 2 Short to positive (B+)	
P0050	16434	O2 sensor heater circuit, Bank 1, Sensor 1 Malfunction	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
P0051	16435	O2 sensor heater circuit, Bank 1, Sensor 1 Short to Ground	
P0052	16436	O2 sensor heater circuit, Bank 1, Sensor 1 Short to positive (B+)	
P0056	16440	O2 sensor heater circuit, Bank 1, Sensor 2 Malfunction	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
P0057	16441	O2 sensor heater circuit, Bank 1, Sensor 2 Short to Ground	
P0058	16442	O2 sensor heater circuit, Bank 1, Sensor 2 Short to positive (B+)	

DTC code		DTC text	Corrective action
SAE	VAG		
P0101	16485	Mass Air Flow (MAF) Sensor -G70- Incorrect signal	○ Check Mass Air Flow (MAF) Sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking**
P0102	16486	Mass Air Flow (MAF) Sensor -G70- Signal too small	○ Check hose setup of crankcase ventilation for secure seating and

			for proper seal
P0103	16487	Mass Air Flow (MAF) Sensor -G70- Signal too great	
P0112	16496	Intake Air Temperature (IAT) Sensor -G42- Signal too small	Check Intake Air Temperature (IAT) Sensor. Refer to **Intake Air Temperature (IAT) sensor -G42-, checking**.
P0113	16497	Intake Air Temperature (IAT) Sensor -G42- Signal too great	
P0116	16500	Engine coolant temperature (ECT) Sensor -G62- Incorrect signal	Test Engine coolant temperature (ECT) Sensor. Refer to **Engine Coolant Temperature (ECT) sensor -G62-, checking**
P0117	16501	Engine coolant temperature (ECT) Sensor -G62- Signal too small	Check coolant thermostat. Refer to **19 ENGINE - COOLING SYSTEM**
P0118	16502	Engine coolant temperature (ECT) Sensor -G62- Signal too great	

DTC code		DTC text	Corrective action
SAE	VAG		
P0121	16505	Throttle Position (TP) Sensor -G69-. Incorrect signal	Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**.
P0122	16506	Throttle Position (TP) Sensor -G69-. Signal too low	
P0123	16507	Throttle Position (TP) Sensor -G69-.	

DTC code		DTC text	Corrective action
SAE	VAG		
		Signal too high	
P0130	16514	O2 sensor circuit, Bank 1, Sensor 1 Malfunction	○ Check oxygen sensor and oxygen sensor control before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**
P0133	16517	O2 sensor circuit, Bank 1, Sensor 1 Signal too slow	○ Check oxygen sensor before Three Way catalytic converter and oxygen sensor behind catalytic converter for swapped installation ○ Check oxygen sensor and oxygen sensor control before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**
P0135	16519	O2 sensor heater circuit, Bank 1, Sensor 1 Malfunction	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
P0136	16520	O2 sensor circuit, Bank 1, Sensor 2	○ Check oxygen sensor and oxygen

		Malfunction	sensor control behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking**
P0137	16521	O2 sensor circuit, Bank 1, Sensor 2 Voltage too low	
P0138	16522	O2 sensor circuit, Bank 1, Sensor 2 Voltage too high	
P0139	16523	O2 sensor circuit, Bank 1, Sensor 2 Signal too slow	
P0140	16524	O2 sensor circuit, Bank 1, Sensor 2 No activity detected	
P0141	16525	O2 sensor heater circuit, Bank 1, Sensor 2 Malfunction	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**

DTC code		DTC text	Corrective action
SAE	VAG		
P0150	16534	O2 sensor circuit, Bank 2, Sensor 1 Malfunction	○ Check oxygen sensor and oxygen sensor control before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**
P0151	16535	O2 sensor circuit, Bank 2, Sensor 1	

		Voltage too low	
P0152	16536	O2 sensor circuit, Bank 2, Sensor 1 Voltage too high	
P0153	16537	O2 sensor circuit, Bank 2, Sensor 1 Signal too slow	○ Check oxygen sensor before catalytic converter and oxygen sensor behind catalytic converter for swapped installation
P0154	16538	O2 sensor circuit, Bank 2, Sensor 1 No activity detected	○ Check oxygen sensor and oxygen sensor control before catalytic converter (TWC). Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**
P0155	16539	O2 sensor heater circuit, Bank 2, Sensor 1 Malfunction	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**

DTC code		DTC text	Corrective action
SAE	VAG		
P0156	16540	O2 sensor circuit, Bank 2, Sensor 2 Malfunction	○ Check oxygen sensor and oxygen sensor control behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter,**

			checking
P0157	16541	O2 sensor circuit, Bank 2, Sensor 2 Voltage too low	
P0158	16542	O2 sensor circuit, Bank 2, Sensor 2 Voltage too high	
P0159	16543	O2 sensor circuit, Bank 2, Sensor 2 Signal too slow	
P0160	16544	O2 sensor circuit, Bank 2, Sensor 2 No activity detected	
P0161	16545	O2 sensor heater circuit, Bank 2, Sensor 2 Malfunction in heater circuit	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**

DTC code		DTC text	Corrective action
SAE	VAG		
P0170	16554	Fuel trim, Bank 1 Malfunction	○ Perform road test (fuel in oil) ○ Check for leaks (unmetered air) in intake air system. Refer to **Intake air system for leaks (unmetered air), checking**. ○ Check hoses (intake manifold changeover valves and secondary air inlet) ○ Check fuel system pressure. Refer to **Fuel pressure regulator and holding pressure (vehicles up to**

			06.03), checking
P0171	16555	Fuel trim, Bank 1 System too lean	○ Check Mass Air Flow (MAF) Sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking** ○ Check oxygen sensor before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking** ○ Check oxygen sensor behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking** ○ Check secure fit and leak-tightness of crankcase breather hose connections
P0172	16556	Fuel trim, Bank 1 System too rich	○ Check injectors. Refer to **Fuel injectors, checking** ○ Checking exhaust system for leaks

DTC code		DTC text	Corrective action
SAE	VAG		
P0173	16557	Fuel trim, Bank 2 Malfunction	○ Perform road test (fuel in oil)

			○ Check for leaks (unmetered air) in intake air system. Refer to **Intake air system for leaks (unmetered air), checking**. ○ Check hoses (intake manifold changeover valves and secondary air inlet) ○ Check fuel system pressure. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**
P0174	16558	Fuel trim, Bank 2 System too lean	○ Check mass air flow sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking** ○ Check oxygen sensor before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking** ○ Check oxygen sensor behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking** ○ Check secure fit and leak-tightness of crankcase breather hose connections
P0175	16559	Fuel trim, Bank 2	

		System too rich	Check injectors. Refer to **Fuel injectors, checking** Checking exhaust system for leaks
P0196	16580	Engine oil temperature sensor -G8- Incorrect signal	Check instrument cluster DTC memory Test oil temperature sensor. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

DTC code		DTC text	Corrective action
SAE	VAG		
P0201	16585	Cylinder 1 Fuel Injector 1 -N30- Electrical malfunction	Check injectors. Refer to **Fuel injectors, checking**
P0202	16586	Cylinder 2 Fuel Injector -N31- Electrical malfunction	
P0203	16587	Cylinder 3 Fuel Injector -N32- Electrical malfunction	
P0204	16588	Cylinder 4 Fuel Injector -N33- Electrical malfunction	
P0205	16589	Cylinder 5 Fuel Injector -N83- Electrical malfunction	
P0206	16590	Cylinder 6 Fuel Injector -N84- Electrical malfunction	
P0219	16603	Maximum engine speed exceeded	Repair mechanical damage

DTC code		DTC text	Corrective action
SAE	VAG		
P0221	16605	Angle sensor -2- for throttle drive (power accelerator activation) -	Test Angle sensor -2- for throttle drive (power accelerator

DTC code		DTC text	Corrective action
SAE	VAG		
		G188- Incorrect signal	activation). Refer to **Angle sensor for throttle valve actuator, checking**
P0222	16606	Angle sensor -2- for throttle drive (power accelerator activation) - G188- Signal too small	
P0223	16607	Angle sensor -2- for throttle drive (power accelerator activation) - G188- Signal too great	
P0230	16614	Fuel Pump (FP) Relay - J17- Malfunction	○ Check fuel pump relay. Refer to **Fuel Pump (FP) relay - J17- and activation, checking**
P0261	16645	Cylinder 1 Fuel Injector 1 -N30- Short to Ground	○ Check injectors. Refer to **Fuel injectors, checking**
P0262	16646	Cylinder 1 Fuel Injector 1 -N30- Short to positive (B+)	
P0264	16648	Cylinder 2 Fuel Injector - N31- Short to Ground	
P0265	16649	Cylinder 2 Fuel Injector - N31- Short to positive (B+)	
P0267	16651	Cylinder 3 Fuel Injector - N32- Short to ground	○ Check injectors. Refer to **Fuel injectors, checking**
P0268	16652	Cylinder 3 Fuel Injector - N32- Short to positive (B+)	
P0270	16654	Cylinder 4 Fuel Injector -	

		N33- Short to ground	
P0271	16655	Cylinder 4 Fuel Injector - N33- Short to positive (B+)	
P0273	16657	Cylinder 5 Fuel Injector - N83- Short to Ground	
P0274	16658	Cylinder 4 Fuel Injector - N83- Short to positive (B+)	
P0276	16660	Cylinder 6 Fuel Injector - N84- Short to Ground	
P0277	16661	Cylinder 4 Fuel Injector - N84- Short to positive (B+)	

DTC code		**DTC text**	**Corrective action**
SAE	VAG		
P0300	16684	Misfire detected	○ Test misfire detection. Refer to **Misfire detection, checking**
P0301	16685	Cyl. 1 misfire detected	○ Refuel vehicle
P0302	16686	Cyl. 2 misfire detected	○ Check hose setup of crankcase ventilation for secure seating and for proper seal
P0303	16687	Cyl. 3 misfire detected	
P0304	16688	Cyl. 4 misfire detected	
P0305	16689	Cyl. 5 misfire detected	
P0306	16690	Cyl. 6 misfire detected	

DTC code		**DTC text**	**Corrective action**
SAE	VAG		
P0321	16705	Engine Speed (RPM) Sensor -G28- Incorrect signal	○ Check Engine Speed (RPM) Sensor. Refer to **Engine speed (RPM) sensor -G28-, checking**.

P0322	16706	Engine Speed (RPM) Sensor -G28- No signal	
P0324	16708	Knock control Malfunction	○ Check knock control. Refer to **Knock control stop, checking**
P0327	16711	Knock Sensor (KS) 1 -G61- Signal too low	○ Check Knock sensor 1. Refer to **Knock sensors, checking**
P0328	16712	Knock sensor 1 -G61- Signal too high	
P0332	16716	Knock Sensor (KS) 2 -G66- Signal too low	
P0333	16717	Knock Sensor (KS) 2 -G66- Signal too high	

DTC code		DTC text	Corrective action
SAE	VAG		
P0340	16724	Camshaft Position (CMP) sensor Malfunction	○ Check CMP sensor. Refer to **Camshaft Position (CMP) sensor, checking**
P0341	16725	Camshaft Position (CMP) sensor -G40- Incorrect signal	
P0342	16726	Camshaft Position (CMP) sensor -G40- Signal too low	
P0343	16727	Camshaft Position (CMP) sensor -G40- Signal too high	
P0345	16729	Camshaft Position (CMP) sensor -G163- Malfunction	
P0346	16730	Camshaft Position (CMP) sensor -G163- Incorrect signal	
P0347	16731	Camshaft Position (CMP) sensor -G163-	

		Short to Ground	
P0348	16732	Camshaft Position (CMP) sensor -G163- Short to positive (B+)	

DTC code		DTC text	Corrective action
SAE	VAG		
P0351	16735	Ignition activation cyl. 1 Malfunction	○ Check ignition coils with output stages. Refer to **Ignition coils with output stages, checking**.
P0352	16736	Ignition activation cyl. 2 Malfunction	
P0353	16737	Ignition activation cyl. 3 Malfunction	
P0354	16738	Ignition activation cyl. 4 Malfunction	
P0355	16739	Ignition activation cyl. 5 Malfunction	
P0356	16740	Ignition activation cyl. 6 Malfunction	

DTC code		DTC text	Corrective action
SAE	VAG		
P0365	16749	Camshaft Position (CMP) Sensor 3 -G300- Malfunction	○ Check CMP sensor. Refer to **Camshaft Position (CMP) sensor, checking**
P0366	16750	Camshaft Position (CMP) Sensor 3 -G300- Incorrect signal	
P0367	16751	Camshaft Position (CMP) Sensor 3 -G300- Signal too low	
P0368	16752	Camshaft Position (CMP) Sensor 3 -G300- Signal too high	
P0390	16774	Camshaft Position (CMP) Sensor 3 -G301- Malfunction	
P0391	16775	Camshaft Position (CMP)	

		Sensor 3 -G301- Incorrect signal	
P0392	16776	Camshaft Position (CMP) Sensor 3 -G301- Signal too low	
P0393	16777	Camshaft Position (CMP) Sensor 3 -G301- Signal too high	

DTC code		DTC text	Corrective action
SAE	VAG		
P0411	16795	Secondary air system Through flow faulty	○ Check for leaks (unmetered air) in intake air system. Refer to **Intake air system for leaks (unmetered air), checking**. ○ Check secondary air system. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P0413	16797	Secondary Air Injection (AIR) Solenoid Valve -N112- Open circuit	Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P0414	16798	Secondary Air Injection (AIR) Solenoid Valve -N112- Short circuit	
P0418	16802	Secondary air pump relay -J299- Malfunction	
P0421	16805	Primary catalytic converter, Bank 1 Too inefficient	○ Replace catalytic converter
P0431	16815	Primary catalytic converter, Bank 2 Too inefficient	○ Generate readiness code. Refer to **Readiness code**
P0441	16825	EVAP emission control system Purge flow faulty 1)	○ Check solenoid valve 1 for Evaporative

			emission (EVAP) canister purge regulator valve. Refer to **Evaporative Emission (EVAP) canister purge regulator valve - N80-, checking**

DTC code		DTC text	Corrective action
SAE	VAG		
P0442	16826	EVAP emission control system Small leak detected	○ Check fuel supply and ventilation systems for leaks
P0455	16839	EVAP emission control system Large leak detected	Refer to **20 - FUEL SUPPLY SYSTEM**
P0456	16840	EVAP emission control system Pin-hole leak detected	
P0491	16875	Secondary air system, Bank 1 Malfunction	. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P0492	16876	Secondary air system, Bank 2 Malfunction	
P0501	16885	Vehicle speed sensor Range/performance malfunction	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P0506	16890	Idle control system RPM lower than expected	○ Check throttle valve control module. Refer to **Throttle valve control module - J338-, checking** ○ Check mass air flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor -**

			G70-, checking
P0507	16891	Idle control system RPM higher than expected	○ Perform adaptation of throttle valve control module. Refer to **Throttle valve control module -J338-, adaptation** ○ Check intake air system (unmetered air) for leaks. Refer to **Intake air system for leaks (unmetered air), checking** ○ Check hose setup of crankcase ventilation for secure seating and for proper seal

DTC code		**DTC text**	**Corrective action**
SAE	VAG		
P0513	16897	Wrong Immobilizer code	○ Adapt electronic immobilizer to engine control module
P0560	16944	System voltage Malfunction	○ Check supply voltage for control module. Refer to **Engine Control Module (ECM) power supply, checking**
P0562	16946	System voltage Low voltage	
P0563	16947	System voltage High voltage	
P0568	16952	Cruise Control Switch -E45- set signal Incorrect signal	○ Check cruise control system. Refer to **Cruise Control System (CCS), testing**

P0571	16955	Brake light switch -F-1) Incorrect signal	○ Check brake light switch and brake pedal switch. Refer to **Brake light switch and brake pedal switch, checking**
P0600	16984	Serial Comm. link (Data bus drive) Message missing	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**

1) The brake pedal switch (cruise control/diesel direct -F47-) is monitored in addition to the brake light switch -F-.

DTC code		DTC text	Corrective action
P0601	16985	Internal control module memory Check sum error	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
P0602	16986	Control module programming Error/malfunction	○ Code engine control module. Refer to **Control module, coding**
P0604	16988	Internal control module Random Access Memory (RAM) Error	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
P0605	16989	Internal control module Read Only Memory (ROM) Test error	
P0606	16990	ECM processor fault	

DTC code		DTC text	Corrective action
SAE	VAG		
P0638	17022	Throttle valve control module -J338- Incorrect signal	○ Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**.
P0642	17026	Knock control Control module malfunction	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
P0660	17044	Intake manifold changeover function Malfunction	○ Test intake manifold changeover. Refer to **Intake manifold change-over, checking**.
P0661	17045	Intake manifold changeover function Short to Ground	
P0662	17046	Intake manifold changeover function Short to positive	
P0685	17069	Main relay Motronic engine control module (ECM) power supply relay -J271- Open circuit	○ Check Motronic engine control module (ECM) power supply relay -J271-. Refer to **Motronic Engine Control Module (ECM) power supply relay -J271-, checking**
P0686	17070	Main relay Motronic engine control module (ECM) power supply relay -J271- Short to Ground	
P0687	17071	Main relay Motronic engine control module	

		(ECM) power supply relay -J271- Short to positive	
P0688	17072	Main relay, load circuit Motronic engine control module (ECM) power supply relay -J271- Open circuit	

DTC code		DTC text	Corrective action
SAE	VAG		
P0704	17088	Clutch vacuum vent valve switch -F36- Incorrect signal	○ Check clutch pedal switch. Refer to **Clutch pedal switch check -F36- , checking**.
P1055	17463	Camshaft adjustment, exhaust, Bank 1 Short to positive (B+)	. Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
P1056	17464	Camshaft adjustment, exhaust, Bank 1 Short to Ground	
P1057	17465	Camshaft adjustment, exhaust, Bank 1 Open circuit	
P1058	17466	Camshaft adjustment, exhaust, Bank 2 Short to positive (B+)	
P1059	17467	Camshaft adjustment, exhaust, Bank 2 Short to Ground	
P1060	17468	Camshaft adjustment, exhaust, Bank 2 Open circuit	

DTC code		DTC text	Corrective action
SAE	VAG		
P1102	17510	O2 sensor heating circuit, Bank 1, Sensor 1 Short to positive	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter,**

			checking heating
P1103	17511	O2 sensor heating circuit, Bank 1, Sensor 1 Output too low	
P1105	17513	O2 sensor heating circuit, Bank 1, Sensor 2 Short to positive (B+)	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
P1107	17515	O2 sensor heating circuit, Bank 2, Sensor 1 Short to positive (B+)	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
P1108	17516	O2 sensor heating circuit, Bank 2, Sensor 1 Output too low	
P1110	17518	O2 sensor heating circuit, Bank 2, Sensor 2 Short to positive (B+)	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
P1111	17519	O2 Control, Bank 1 System too lean	○ Check oxygen sensor adaptation values and control ○ Check hose setup of crankcase ventilation for secure seating and for proper seal
P1112	17520	O2 Control, Bank 1 System too rich	○ Check oxygen sensor and oxygen sensor control before catalytic converter. Refer to **Oxygen sensors**

			and oxygen sensor control before catalytic converter, checking

DTC code		DTC text	Corrective action
SAE	VAG		
P1113	17521	Bank 1, Sensor 1 Internal resistance too high	○ First check signal wires for terminal resistances; if there are no terminal resistances: Replace oxygen sensor
P1114	17522	Bank 1, Sensor 2 Internal resistance too high	○ First check signal wires for terminal resistances; if there are no terminal resistances: Replace oxygen sensor
P1115	17523	O2 sensor heater circuit, Bank 1, Sensor 1 Short to Ground	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
P1116	17524	O2 sensor heater circuit, Bank 1, Sensor 1 Open circuit	
P1117	17525	O2 sensor heater circuit, Bank 1, Sensor 2 Short to Ground	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
P1118	17526	O2 sensor heater circuit, Bank 1, Sensor 2 Open circuit	
P1119	17527	O2 sensor heater circuit,	

		Bank 2, Sensor 1 Short to Ground	○ Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
P1120	17528	O2 sensor heater circuit, Bank 2, Sensor 1 Open circuit	

DTC code		DTC text	Corrective action
SAE	VAG		
P1121	17529	O2 sensor heater circuit, Bank 2, Sensor 2 Short to Ground	○ Check oxygen sensor heating behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
P1122	17530	O2 sensor heater circuit, Bank 2, Sensor 2 Open circuit	
P1127	17535	Long term fuel trim (mult.), Bank 1 System too rich	○ Perform road test (fuel in oil) ○ Check for leaks (unmetered air) in intake air system. Refer to **Intake air system for leaks (unmetered air), checking**.
P1128	17536	Long term fuel trim (mult.), Bank 1 System too lean	○ Check hoses (intake manifold changeover valves, secondary air system and crankcase breather) ○ Check fuel system pressure. Refer to **Fuel pressure regulator and**

			holding pressure (vehicles up to 06.03), checking o Check mass air flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking**
P1129	17537	Long term fuel trim (mult.), Bank 2 System too rich	o Check oxygen sensor before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking** o Check oxygen sensor behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking**
P1130	17538	Long term fuel trim (mult.), Bank 2 System too lean	o Check injectors. Refer to **Fuel injectors, checking** o Checking exhaust system for leaks o Check crankcase breather pressure control valve

NOTE: **Mult. = multiplicative means that the malfunction occurs throughout the entire speed range and load range.**

DTCs P1136 to P3305 , VAG 17544 to 19761

DTC code		DTC text	Corrective action
SAE	VAG		
P1136	17544	Long term fuel trim (add.), Bank 1 System too lean	○ Road test vehicle (fuel in oil) ○ Check intake system for leaks (false air). Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**
P1137	17545	Long term fuel trim (add.), Bank 1 System too rich	○ Check hose setup (intake manifold change-over, Secondary Air Injection (AIR) system and crankshaft housing ventilation) ○ Check fuel system pressure. Refer to **Mass Air Flow (MAF) sensor - G70-, checking** ○ Check Mass Air Flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor - G70-, checking**
P1138	17546	Long term fuel trim (add.), Bank 2 System too lean	○ Check oxygen sensor before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking** ○ Check oxygen sensor behind catalytic converter.

			Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking**
P1139	17547	Long term fuel trim (add.), Bank 2 System too rich	○ Check Evaporative Emission (EVAP) canister purge regulator valve. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking** ○ Check fuel injectors. Refer to **Fuel injectors, checking** ○ Check exhaust system for proper seal ○ Check pressure regulation valve of crankshaft housing ventilation
P1140	17548	Bank 2, Sensor 2 Internal resistance too high	○ Next, check signal wires for terminal resistances; if no terminal resistances are present: replace oxygen sensor

NOTE: **add. = additive means that malfunction only has effect at idle**

DTC code		DTC text	Corrective action
SAE	VAG		
P1141	17549	Load calculation cross check Range/performance	○ Check whether throttle valve is dirty on suction pipe side

P1142	17550	Load calculation cross check Lower limit exceeded	○ Check whether correct throttle valve control module was installed
P1143	17551	Load calculation cross check Upper limit exceeded	○ Check mass air flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor - G70-, checking**
P1147	17555	O2 control, Bank 2 System too lean	○ Check oxygen sensor adaptation values and control ○ Check hose setup of crankcase ventilation for secure seating and for proper seal
P1148	17556	O2 control, Bank 2 System too rich	○ Check oxygen sensor learned values and oxygen sensor control. Refer to **Checking oxygen sensor learned values and oxygen sensor control**
P1149	17557	O2 control, Bank 1 Out of range	○ Check oxygen sensor adaptation values and control ○ Check fuel system pressure. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**
P1150	17558	O2 control, Bank 2 Out of range	○ Check intake system for leaks (unmetered air). Refer to **Intake air system for leaks (unmetered air),**

			checking ○ Check hose setup of crankcase ventilation for secure seating and for proper seal ○ Check oxygen sensor learned values and oxygen sensor control. Refer to **Checking oxygen sensor learned values and oxygen sensor control**

DTC code		Fault readout	Corrective action
SAE	VAG		
P1171	17579	Angle sensor -2- for throttle drive (power accelerator activation) -G188- Incorrect signal	○ Test angle sensor for throttle valve actuator. Refer to **Angle sensor for throttle valve actuator, checking**
P1172	17580	Angle sensor -2- for throttle drive (power accelerator activation) -G188- Signal too low	
P1173	17581	Angle sensor -2- for throttle drive (power accelerator activation) -G188- Signal too high	
P1176	17584	O2 correction behind cat., Bank 1 Control limit reached	○ Check oxygen sensor aging before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking aging**
P1177	17585	O2 correction behind cat., Bank 2	○ Check oxygen sensor aging

DTC code		DTC text	Corrective action
SAE	VAG		
		Control limit reached	behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking aging**
P1213	17621	Cylinder 1 Fuel Injector -N30- Short to positive (B+)	○ Check injectors. Refer to **Fuel injectors, checking**
P1214	17622	Cylinder 2 Fuel Injector -N31- Short to positive (B+)	
P1215	17623	Cylinder 3 Fuel Injector -N32- Short to positive (B+)	
P1216	17624	Cylinder 4 Fuel Injector -N33- Short to positive (B+)	○ Check injectors. Refer to **Fuel injectors, checking**
P1217	17625	Cylinder 5 Fuel Injector -N83- Short to positive (B+)	
P1218	17626	Cylinder 6 Fuel Injector -N84- Short to positive (B+)	
P1225	17633	Cylinder 1 Fuel Injector -N30- Short to Ground	
P1226	17634	Cylinder 2 Fuel Injector -N31- Short to Ground	
P1227	17635	Cylinder 3 Fuel Injector -N32- Short to Ground	
P1228	17636	Cylinder 4 Fuel Injector -N33- Short to Ground	
P1229	17637	Cylinder 5 Fuel Injector -N83- Short to Ground	

P1230	17638	Cylinder 6 Fuel Injector -N84- Short to Ground	

DTC code		DTC text	Corrective action
SAE	VAG		
P1237	17645	Injector, cylinder 1 -N30- Open circuit	○ Check injectors. Refer to **Fuel injectors, checking**
P1238	17646	Injector, cylinder 2 -N31- Open circuit	
P1239	17647	Injector, cylinder 3 -N32- Open circuit	
P1240	17648	Injector, cylinder 4 -N33- Open circuit	
P1241	17649	Injector, cylinder 5 -N83- Open circuit	
P1242	17650	Injector, cylinder 6 -N84- Open circuit	
P1250	17658	Fuel level Too low	○ Follow-on malfunction. Refer to Note ○ Refuel vehicle, erase DTC memory ○ Check DTC memory of instrument cluster

NOTE: **The malfunction "Fuel level too low" is stored only in conjunction with misfiring or malfunctions concerning oxygen sensor (O2S) control if too little fuel is or was in the tank. The DTC is stored in the control module as static malfunction and is not set as a sporadic DTC even if the vehicle is refuelled in the meantime.**

DTC code		DTC text	Corrective action
SAE	VAG		
P1296	17704	Malfunction in coolant system	○ Check coolant fan -V7-. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

P1325	17733	Knock control, cylinder 1 Control limit reached	○ Check knock control. Refer to **Knock control stop, checking**
P1326	17734	Knock control, cylinder 2 Control limit reached	
P1327	17735	Knock control, cylinder 3 Control limit reached	
P1328	17736	Knock control, cylinder 4 Control limit reached	
P1329	17737	Knock control, cylinder 5 Control limit reached	
P1330	17738	Knock control, cylinder 6 Control limit reached	

DTC code		DTC text	Corrective action
SAE	VAG		
P1335	17743	Engine torque monitoring 2 Control limit exceeded	○ Extreme leakage, check intake air system for leaks (unmetered air). Refer to **Intake air system for leaks (unmetered air), checking**. ○ Check intake air temperature sensor. Refer to **Intake Air Temperature (IAT) sensor -G42-, checking**.
P1336	17744	Engine torque control Adaptation at limit	○ Check Mass air flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking** ○ Check intake air temperature sensor.

			Refer to **Engine Coolant Temperature (ECT) sensor -G62-, checking**
P1337	17745	Camshaft position (CMP) sensor -G40-, Bank 1 Short to Ground	○ Check CMP sensor. Refer to **Camshaft Position (CMP) sensor, checking**
P1338	17746	Camshaft position (CMP) sensor -G40-, Bank 1 Open circuit/short to positive (B+)	
P1340	17748	Camshaft/crankshaft position sensor signals Out of sequence	○ Phase location of CMP sensor. Refer to **Check phase position of CMP sensor**
P1347	17755	Camshaft/crankshaft position sensor signals, Bank 2 Out of sequence	

DTC code		DTC text	Corrective action
SAE	VAG		
P1355	17763	Ignition circuit, Cyl. 1 Open circuit	○ Ignition coils with output stages Checking. Refer to **Ignition coils with output stages, checking**
P1356	17764	Ignition circuit, Cyl. 1 Short to positive (B+)	
P1357	17765	Ignition circuit, Cyl. 1 Short to Ground	
P1358	17766	Ignition circuit, Cyl. 2 Open circuit	
P1359	17767	Ignition circuit, Cyl. 2 Short to positive (B+)	
P1360	17768	Ignition circuit, Cyl. 2 Short to Ground	
P1361	17769	Ignition circuit, Cyl. 3 Open circuit	
P1362	17770	Ignition circuit, Cyl. 3	

		Short to positive (B+)	
P1363	17771	Ignition circuit, Cyl. 3 Short to Ground	

DTC code		DTC text	Corrective action
SAE	VAG		
P1364	17772	Ignition circuit, Cyl. 4 Open circuit	○ Ignition coils with output stages Checking. Refer to **Ignition coils with output stages, checking**
P1365	17773	Ignition circuit, Cyl. 4 Short to positive (B+)	
P1366	17774	Ignition circuit, Cyl. 4 Short to Ground	
P1367	17775	Ignition circuit, Cyl. 5 Open circuit	
P1368	17776	Ignition circuit, Cyl. 5 Short to positive (B+)	
P1369	17777	Ignition circuit, Cyl. 5 Short to Ground	
P1370	17778	Ignition circuit, Cyl. 6 Open circuit	
P1371	17779	Ignition circuit, Cyl. 6 Short to positive (B+)	
P1372	17780	Ignition circuit, Cyl. 6 Short to Ground	

DTC code		DTC text	Corrective action
SAE	VAG		
P1386	17794	Internal control module Knock control circuit error	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
P1387	17795	Internal control module Altitude sensor error	
P1388	17796	Internal control module Drive-by-wire error	

P1391	17799	Camshaft position sensor -G163-, Bank 2 Short to Ground	○ Check CMP sensor. Refer to **Camshaft Position (CMP) sensor, checking**
P1392	17800	Camshaft position (CMP) sensor -G163-, Bank 2 Open circuit/short to positive (B+)	
P1411	17819	Secondary Air Injection system circuit, Bank 2 Flow too low	○ Test secondary air pump fuse ○ Check vacuum hoses ○ Check hose connections from pump to combination valve for secondary air inlet. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P1414	17822	Secondary Air Injection system circuit, Bank 2 Leak detected	○ Check hoses from pump to mechanical secondary air inlet valve, cylinder Bank 2. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**

DTC code		DTC text	Corrective action
SAE	VAG		
P1421	17829	Secondary Air Injection system circuit Short to Ground	. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P1422	17830	Secondary Air Injection system circuit Short to positive (B+)	
P1423	17831	Secondary Air Injection system circuit, Bank 1 Flow too low	○ Test secondary air pump fuse ○ Check vacuum

			hoses ○ Check hose connections from pump to combination valve for secondary air inlet. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P1424	17832	Secondary Air Injection system circuit, Bank 1 Leak detected	○ Check hoses from pump to mechanical secondary air inlet valve, cylinder Bank 2. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**

DTC code		DTC text	Corrective action
SAE	VAG		
P1427	17835	Actuating vacuum pump for brake system Short to positive (B+)	. Refer to **47 - BRAKES - HYDRAULIC COMPONENTS**
P1428	17836	Actuating vacuum pump for brake system Short to Ground	
P1429	17837	Actuating vacuum pump for brake system Open circuit	
P1432	17840	Secondary Air Injection (AIR) Solenoid Valve -N112- Open circuit	. Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**
P1433	17841	Secondary Air Injection (AIR) Pump Relay -J299- Open circuit	
P1434	17842	Secondary Air Injection (AIR) Pump Relay -J299- Short to positive (B+)	
P1435	17843	Secondary Air Injection (AIR) Pump Relay -J299-	

		Short to Ground	

DTC code		DTC text	Corrective action
SAE	VAG		
P1471	17879	Leak Detection Pump (LDP) tank ventilation system Short circuit to B+	○ Perform diagnostic leak test. Refer to **20 - FUEL SUPPLY SYSTEM**
P1472	17880	Leak Detection Pump (LDP) tank ventilation system Short circuit to Ground (GND)	
P1473	17881	Leak Detection Pump (LDP) tank ventilation system Open circuit	
P1475	17883	Leak Detection Pump (LDP) tank ventilation system Malfunction/no signal	
P1476	17884	Leak Detection Pump (LDP) tank ventilation system Malfunction/vacuum pressure too low	

DTC code		DTC text	Corrective action
SAE	VAG		
P1479	17887	Brake vacuum system Mechanical malfunction	○ If fault code 17887 is present: Perform short trip UP 28. Refer to **47 - BRAKES - HYDRAULIC COMPONENTS** ; Electric brake system vacuum pump, checking ○ If test is OK, clear fault, no necessary repair is necessary
P1500	17908	Fuel pump (FP) relay -J17- Malfunction	○ Check fuel pump relay. Refer to **Fuel Pump (FP) relay -J17- and**

			activation, checking
P1502	17910	Fuel pump (FP) relay -J17- Short to positive	
P1512	17920	Intake manifold change-over valve -N156- Short to positive (B+)	○ Check variable intake manifold changeover. Refer to **Intake manifold change-over, checking**
P1515	17923	Intake manifold change-over valve -N156- Short to Ground	
P1516	17924	Intake manifold change-over valve -N156- Open circuit	
P1517	17925	Main relay -J271- Malfunction	○ Check Motronic engine control module (ECM) power supply relay -J271-. Refer to **Motronic Engine Control Module (ECM) power supply relay -J271-, checking**
P1519	17927	Intake camshaft control, Bank 1 Malfunction	. Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
P1522	17930	Intake camshaft control, Bank 2 Malfunction	

DTC code		DTC text	Corrective action
SAE	VAG		
P1523	17931	Crash signal from airbag control module Incorrect signal 2)	○ Check airbag system DTC memory ○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**

P1526	17934	Intake camshaft control circuit, Bank 1 Short to positive (B+)	. Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
P1527	17935	Intake camshaft control circuit, Bank 1 Short to Ground	
P1528	17936	Intake camshaft control circuit, Bank 1 Open circuit	
P1534	17942	Intake camshaft control circuit, Bank 2 Short to positive (B+)	
P1535	17943	Intake camshaft control circuit, Bank 2 Short to Ground	
P1536	17944	Intake camshaft control circuit, Bank 2 Open circuit	
P1539	17947	Clutch pedal switch -F36- Incorrect signal	○ Check clutch pedal switch. Refer to **Clutch pedal switch check -F36-, checking**

2) The malfunction is stored with the relevant signal from airbag control module.

DTC code		DTC text	Corrective action
SAE	VAG		
P1542	17950	Angle sensor -1- for throttle drive (power accelerator activation) -G187- Incorrect signal	○ Test angle sensor for throttle valve actuator. Refer to **Angle sensor for throttle valve actuator, checking**
P1543	17951	Angle sensor -1- for throttle drive (power accelerator activation) -G187- Signal too small	
P1544	17952	Angle sensor -1- for throttle drive (power accelerator activation) -G187- Signal too great	
P1545	17953	Throttle valve control	

		Malfunction	○ Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**.
P1558	17966	Throttle drive (power accelerator activation) -G186- Electrical malfunction in circuit	
P1559	17967	Throttle valve control module -J338- Fault in basic setting	○ Perform adaptation. Refer to **Throttle valve control module -J338-, adaptation**
P1560	17968	Maximum engine speed exceeded	○ Correct mechanical damage
P1564	17972	Throttle valve control module -J338- Undervoltage during basic setting	○ Charge battery, repeat basic setting
P1565	17973	Throttle valve control module -J338- Lower stop not reached	○ Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**
P1568	17976	Throttle valve control module -J338- Mechanical malfunction	

DTC code		DTC text	Corrective action
SAE	VAG		
P1569	17977	Cruise control switch -E45- Incorrect signal	○ Check cruise control system. Refer to **Cruise Control System (CCS), testing**
P1570	17978	Engine control module disabled	○ Adapt electronic immobilizer to engine control module
P1579	17987	Throttle valve control	

		module -J338- Adaptation not started	○ Perform adaptation of throttle valve control module in accordance with preconditions. Refer to **Throttle valve control module -J338-, adaptation**
P1602	18010	Voltage supply, terminal 30 Voltage too low	○ Check supply voltage for control module. Refer to **Engine Control Module (ECM) power supply, checking**
P1603	18011	Internal control module malfunction	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
P1604	18012	Internal control module malfunction	
P1606	18014	Rough-road detection/engine specified torque from ABS control module Electrical malfunction	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P1609	18017	Crash cut-off was activated (crash caused) 3)	○ Perform airbag system On Board Diagnostic (OBD) ○ After final control diagnosis of airbag system erase DTC memory of engine control module. Refer to **Diagnostic Trouble Code (DTC) memory, checking**

3) The malfunction is stored with the relevant signal from airbag control module, also with final control

diagnosis of the airbag system.

DTC code		DTC text	Corrective action
SAE	VAG		
P1610	18018	Internal control module malfunction	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
P1612	18020	Engine control module incorrectly coded	○ Code engine control module. Refer to **Control module, coding**
P1624	18032	Request malfunction lamp on, active 4)	○ Exhaust relevant malfunction of transmission control module ○ Read DTC memory of transmission control module
P1626	18034	Drive data bus No message from transmission control module	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P1628	18036	Drive data bus No message from steering angle sensor	

4) The transmission control module has recognized a malfunction which causes the exhaust emissions of the engine to deteriorate. The malfunction message is sent by the transmission control module to the engine control module which now switches on the Malfunction Indicator Lamp (MIL) -K83-. Notes on MIL -K83-. Refer to **Exhaust Malfunction Indicator Lamp (MIL) in instrument cluster**. At the same time the message P1624 is displayed in the engine control module as an indication that the MIL -K83- was not switched on due to an engine problem but due to a transmission problem.

DTC code		DTC text	Corrective action
SAE	VAG		
P1630	18038	Throttle Position (TP)	○ Checking Throttle

		sensor -G79- Signal too low	Position (TP) Sensor. Refer to **Accelerator position sensor, checking**.
P1631	18039	Throttle Position (TP) sensor -G79- Signal too high	
P1633	18041	Sensor -2- for accelerator pedal position -G185- Signal too low	
P1634	18042	Sensor -2- for accelerator pedal position -G185- Signal too high	
P1635	18043	Drive data bus No message from air-conditioning control module	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P1636	18044	Drive data bus No message from airbag control module	
P1639	18047	Accelerator pedal position sensors 1/2 -G79- + -G185- Incorrect signal	○ Check accelerator pedal position sensor. Refer to **Accelerator position sensor, checking**
P1640	18048	Internal control module malfunction	○ Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**

DTC code		DTC text	Corrective action
SAE	VAG		
P1648	18056	Data bus drive Faulty	○ Check CAN bus. Refer to **Data exchange between**

			engine control module and other CAN-control modules, checking
P1649	18057	Data bus drive No message from ABS control module	
P1650	18058	Data bus drive No message from instrument panel	
P1659	18067	Coolant fan activation 1 Short to positive (B+)	○ Check coolant fan -V7-. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations
P1660	18068	Coolant fan activation 1 Short to Ground	
P1672	18080	Coolant fan activation 1 Open circuit/short circuit to Ground	

DTC code		**DTC text**	**Corrective action**
SAE	VAG		
P1682	18090	Drive data bus Incorrect message from ABS control module	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P1683	18091	Drive data bus Incorrect message from airbag control module	
P1687	18095	Data bus drive Incorrect message from air conditioner control module	
P1696	18104	Data bus drive Incorrect message from steering column electronics	○ Engine control module coded for CCS, but no CCS installed. Deactivate CCS. Refer to **Cruise control system, activating/deactivating** ○ Check CAN bus. Refer to

			Data exchange between engine control module and other CAN-control modules, checking
P1698	18106	Read out DTC memory of steering column electronics	○ Check steering column electronics DTC memory
P1699	18107	Data bus drive No message from steering column electronics	○ Engine control module coded for CCS, but no CCS installed. Deactivate CCS. Refer to **Cruise control system, activating/deactivating** ○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P1912	18320	Brake Booster Pressure Sensor -G294- Open circuit/short to positive (B+)	. Refer to **47 - BRAKES - HYDRAULIC COMPONENTS**
P1913	18321	Brake Booster Pressure Sensor -G294- Short to Ground	

DTC code		DTC text	Corrective action
SAE	VAG		
P1915	18323	Coolant circulation pump relay -J151- Short to positive (B+)	○ Engine control module coded for hot-country function, but no pump for coolant run-on. Deactivate hot country function. Refer to **Hot-country function, activating/deactivating**
P1916	18324	Coolant circulation pump relay -J151- Short to Ground	○ Check -J151-. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations
P1917	18325	Coolant circulation pump relay -J151- Open circuit	

P1931	18339	Coolant FC (Fan Control) Control Module -J293- Malfunction	○ Check -J293-. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

DTC code		DTC text	Corrective action
SAE	VAG		
P1996	18404	Friction too high Code E1 Camshaft adjustment intake camshaft, bank 1	○ Check camshaft adjustment. Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
P1997	18405	Friction too high Code A1 Camshaft adjustment outlet camshaft, bank 1	○ Check engine oil pressure. Refer to **17 ENGINE - LUBRICATION**
P1998	18406	Friction too high Code E2 Camshaft adjustment intake camshaft, bank 2	
P1999	118407	Friction too high Code A2 Camshaft adjustment outlet camshaft, bank 2	

NOTE:

- **Camshaft adjustment diagnostic is influenced by the oil temperature sensor. If the malfunction P0196/16580 "Engine Oil Temperature Sensor -G8-, Incorrect signal" is stored simultaneously, check sensor first.**
- **An entry into DTC memory can also occur due to mechanical problems: Running-in process not yet completed (friction), camshaft is seized (perform a visual check of camshaft bearings).**

DTC code		DTC text	Corrective action
SAE	VAG		
P2101	18533	Throttle valve control Malfunction	○ Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**.
P2122	18554	Throttle Position (TP) Sensor -G79- Signal too small	○ Check throttle position (TP) sensor. Refer to

			Accelerator position sensor, checking
P2127	18559	Sender -2- for accelerator pedal position 2 -G185- Signal too small	
P2128	18560	Sender -2- for accelerator pedal position 2 -G185- Signal too small	
P2138	18570	Accelerator position sensors 1/2 -G79- + -G185- Incorrect signal	

DTC code		**DTC text**	**Corrective action**
SAE	VAG		
P2181	18613	Malfunction in cooling system	○ Check Engine Coolant Temperature (ECT) sensor -G62- ○ Check thermostat. Refer to **19 ENGINE - COOLING SYSTEM** ; cooling system components, removing and installing
P3041	19497	Data bus drive Implausible temperature message from instrument cluster	○ Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**
P3081	19537	Engine temperature too low	○ Check Engine Coolant Temperature (ECT) sensor -G62- ○ Check thermostat. Refer to **19 ENGINE - COOLING**

			SYSTEM ; cooling system components, removing and installing

DTC code		DTC text	Corrective action
P3262	19718	Exhaust gas Bank 1/2 Heated oxygen sensors (HO2S) behind catalytic converter interchanged	○ Check for interchange. Refer to **Oxygen sensors behind catalytic converter, recognizing interchanges**
P3300	19756	Camshaft Position (CMP) Sensor 3, exhaust -G300-, Bank 1 Short to Ground	○ Check CMP sensor. Refer to **Camshaft Position (CMP) sensor, checking**
P3301	19757	Camshaft Position (CMP) Sensor 3, exhaust -G300-, Bank 1 Open circuit/short to positive (B+)	
P3302	19758	Camshaft Position (CMP) Sensor 4, exhaust -G301-, Bank 2 Short to Ground	
P3303	19759	Camshaft Position (CMP) Sensor 4, exhaust -G301-, Bank 2 Open circuit/short to positive (B+)	
P3304	19760	Exhaust camshaft/crankshaft position sensor, Bank 1 Incorrect assignment	○ Check connectors and cable routing
P3305	19761	Exhaust camshaft/crankshaft position sensor, Bank 2 Incorrect assignment	

OUTPUT DIAGNOSTIC TEST MODE (DTM)

Output Diagnostic Test Mode (DTM)

NOTE:

- **The Output Diagnostic Test Mode (DTM) (shown as Final Control Diagnosis on scan tool) can only be performed with the engine stopped and the ignition switched on.**
- **During actuator diagnosis, the individual actuators (with the exception of the injectors) are operated in turn for about one minute unless the next actuator is selected by pressing the delta button.**
- **The control elements can be checked acoustically or by way of touch.**
- **Output Diagnostic Test Mode (DTM) is aborted if it is not switched further after one minute of activation time, the engine is started or an RPM signal is recognized.**
- **Before restarting the Output Diagnostic Test Mode (DTM) the engine must be started and the ignition switched off and on again.**

Vehicles with control module No. 8E0 909...

Actuation sequence	
1	Evaporative emission (EVAP) canister purge regulator valve -N80-
2	Secondary Air Injection (AIR) Solenoid Valve -N112-
3	Secondary Air Injection (AIR) Pump Relay -J299-
4	Intake manifold change-over valve -N156-
5	Valve -1- for camshaft adjustment -N205-, Bank
6	Leak Detection Pump (LDP) tank ventilation system
7	Valve -2- for camshaft adjustment -N208-, Bank 2
8	Exhaust camshaft timing control, Bank 1
9	Exhaust camshaft timing control, Bank 2
10	Activate brake vacuum pump 1)
11	Coolant fan activation 1
12	Coolant Circulation Pump Relay -J151- 2)

1) Only on vehicles with automatic transmission.

2) Only in vehicles with hot-country function.

Actuation sequence	
13	Cylinder 1 Fuel Injector -N30-
14	Cylinder 4 Fuel Injector -N33-
15	Cylinder 3 Fuel Injector -N32-
16	Cylinder 6 Fuel Injector -N84-
17	Cylinder 2 Fuel Injector -N31-
18	Cylinder 5 Fuel Injector -N83-

Test requirements:

- Fuses for engine electronics OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051 and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

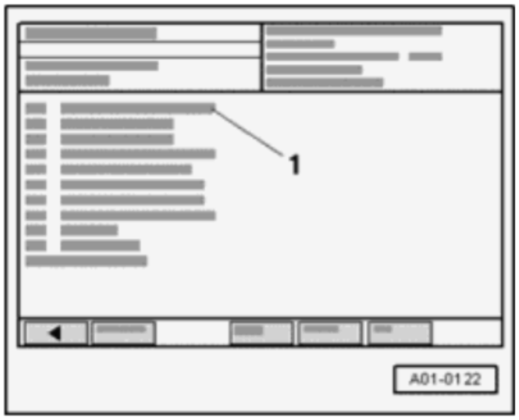

Fig. 14: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "03 - Final control diagnosis".

Actuating evaporative emission (EVAP) canister purge regulator valve (tank breather valve)

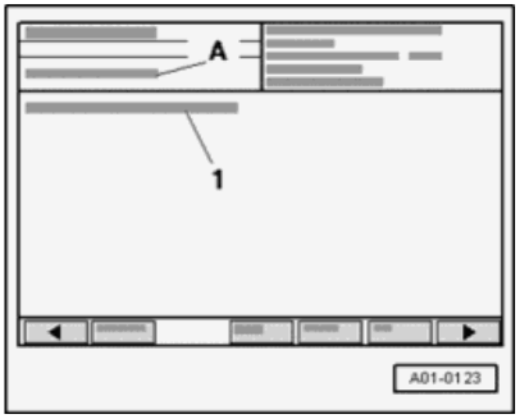

Fig. 15: Display On VAS 5051 - (1st Control Element In Test & Evaporative Emission (EVAP) Canister Purge Regulator Valve-N80-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

1 - Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-

- ○ Press delta button.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

NOTE: Fuel pump must run during activation time, the flow noise at fuel pressure regulator must be clearly audible. If fuel pump does not run, check activation. Refer to Checking activation of fuel pump relay.

If the valve is not actuated (does not click).

- ○ Check solenoid valve 1 for Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking**.

Actuating secondary air injection solenoid valve

- ○ Press delta button.

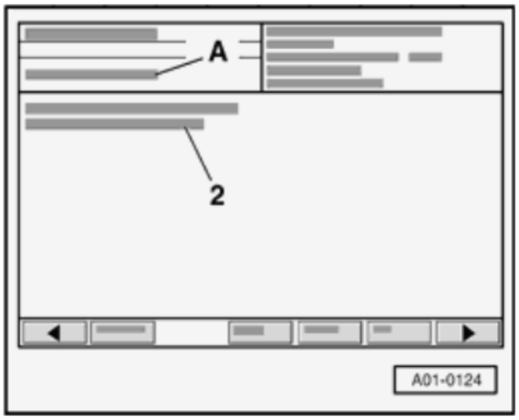

Fig. 16: Display On VAS 5051 - (2nd Control Element In Test & Secondary Air Injection (AIR) Solenoid Valve -N112-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

2 - Secondary Air Injection (AIR) solenoid valve -N112-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

If the valve is not actuated (does not click).

- Check Secondary Air Injection (AIR) solenoid valve -N112-:

Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**

Actuating secondary air injection pump relay

- Press delta button.

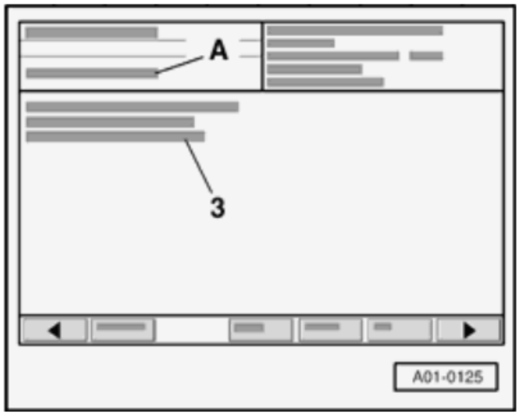

Fig. 17: Display On VAS 5051 - (3rd Control Element In Test & Secondary Air Pump Relay -J299-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

3 - Secondary Air Injection (AIR) Pump Relay -J299-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

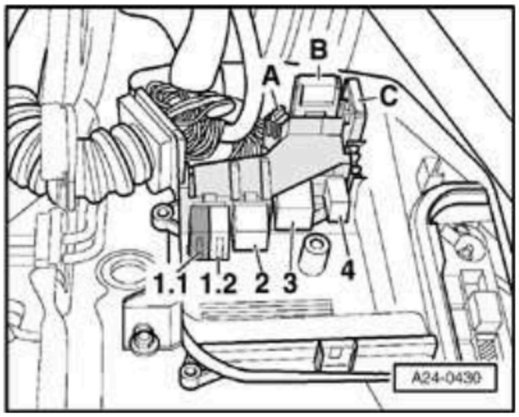

Fig. 18: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The secondary AIR pump relay -J299- (in relay carrier in electronics box, plenum chamber, position 3) switches the engine for the Secondary Air Injection (AIR) pump motor -V101- on and off at approx. 1 minute intervals if the operation has not been switched to the next control element by pressing the delta button.

If secondary air pump does not run intermittently:

- Check Secondary Air Injection (AIR) pump relay -J299-:

Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**

Actuation of intake manifold change-over valve

- Press delta button.

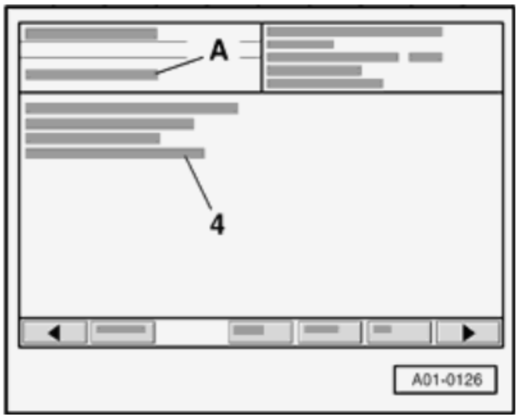

Fig. 19: Display On VAS 5051 - (4th Control Element In Test & Charge Pressure Control Valve -N75)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

4 - Intake manifold change-over valve -N156-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

If the valve is not actuated (does not click).

- Check intake manifold change-over valve -N156-. Refer to **Intake manifold change-over, checking**.

Actuating intake camshaft adjustment valve, Bank 1

- Press delta button.

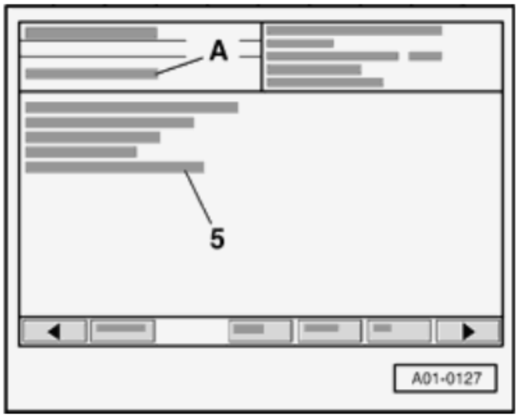

Fig. 20: Display On VAS 5051 - (4th Control Element In Test & Charge Pressure Control Valve -N75)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

5 - Bank 1, Valve -1- for camshaft adjustment -N205-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

If the valve is not actuated (does not click).

- Check camshaft adjustment valves:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

Activating Leak Detection Pump (LDP) tank ventilation system

- Click on delta button

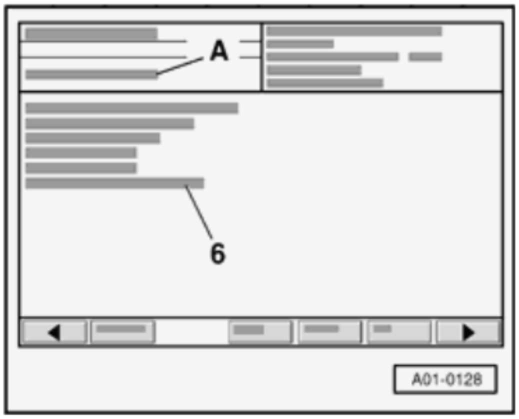

Fig. 21: Display On VAS 5051 - (Actuator In Test & Leak Detection Pump Tank Ventilation System)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

6 - Leak Detection Pump (LDP) tank ventilation system

- Click on delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- The Leak Detection Pump (LDP) -V144- is activated in intervals for approx. 1 minute (clicks), unless the delta button is pressed first to switch to the next actuator.

NOTE: Operating noise of Leak Detection Pump (LDP) is softly audible at left rear wheelhouse.

If Leak Detection Pump (LDP) is not activated (no operating noise audible):

- Check Leak Detection Pump (LDP):

Refer to **20 - FUEL SUPPLY SYSTEM**

Actuating intake camshaft adjustment valve, Bank 2

- Press delta button.

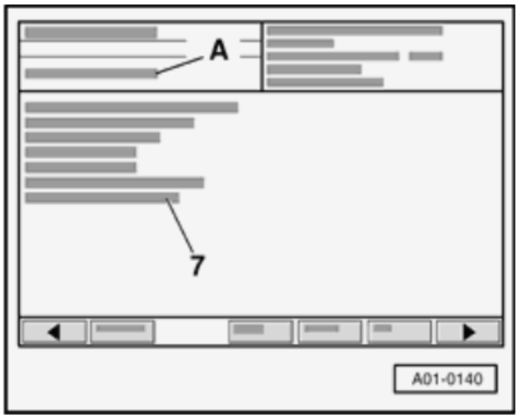

Fig. 22: Display On VAS 5051 - (7th Control Element In Test & Recirculating Valve For Turbocharger - N249-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

7 - Bank 2, Valve -2- for camshaft adjustment -N208-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

If the valve is not actuated (does not click).

- Check camshaft adjustment valves:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

Actuating exhaust camshaft adjustment valve, Bank 1

- Press delta button.

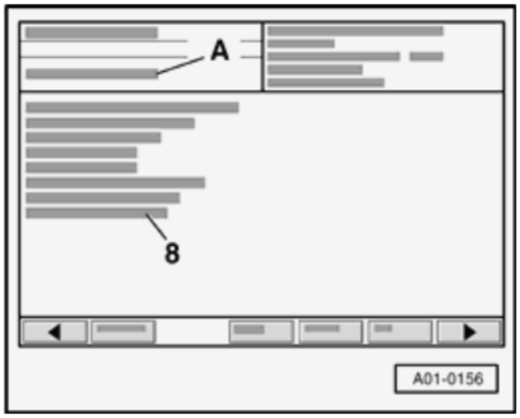

Fig. 23: Display On VAS 5051 - (Activation Of Brake System Vacuum Pump)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

8 - Bank 1, camshaft adjustment (exhaust)

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

If the valve is not actuated (does not click).

- Check camshaft adjustment valves:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

Actuating exhaust camshaft adjustment valve, Bank 2

- Press delta button.

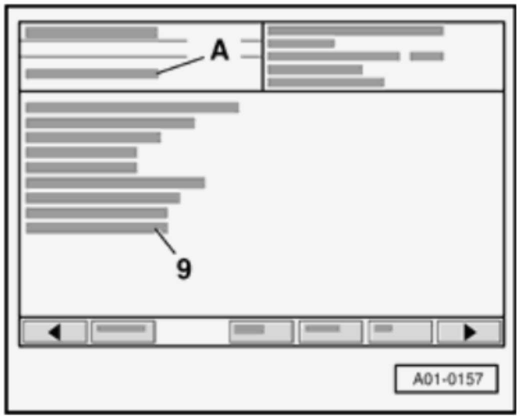

Fig. 24: Display On VAS 5051 - (9th Control Element In Test & Injector - Cyl. 1 -N30-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

9 - Bank 2, camshaft adjustment (exhaust)

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- This valve is activated (clicks) for approx. 1 minute if the operation is not switched to the next control element by pressing the delta button.

If the valve is not actuated (does not click).

- Check camshaft adjustment valves:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

Actuating brake vacuum pump 1)

1) Only on vehicles with automatic transmission.

- Press delta button.

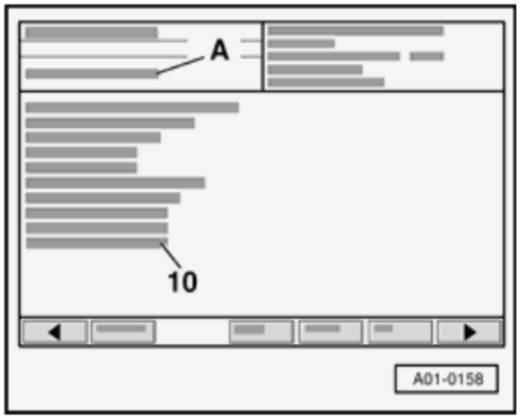

Fig. 25: Display On VAS 5051 - (Cylinder 1 Fuel Injector -N30-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

10 - Activation of brake vacuum pump

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- The brake servo vacuum pump, left front in engine compartment, must start up for a short time, unless the operation has been switched to the next control element by pressing the delta button.

If the brake servo vacuum pump does not start up:

- Check brake servo vacuum pump:

Refer to **47 - BRAKES - HYDRAULIC COMPONENTS**

Actuating coolant fan control

- Press delta button.

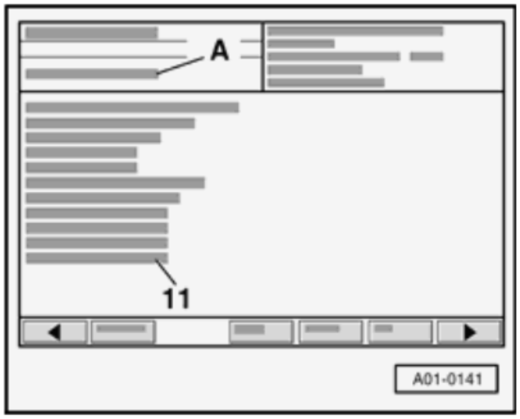

Fig. 26: Display On VAS 5051 - (11th Control Element In Test & Injector - Cyl. 4 -N33-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

11 - Coolant FC (Fan Control) activation 1

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

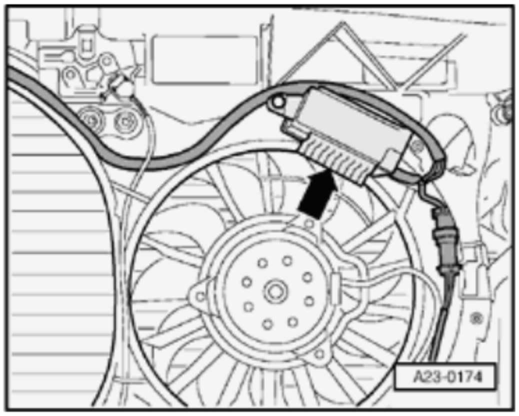

Fig. 27: Identifying Coolant Fan Control 1 -J293-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Coolant FC (Fan Control) Control Module -J293- (top right on fan frame -arrow-) slowly regulates coolant fan once up to maximum RPM, unless the delta button is pressed first, to switch to the next actuator.

If the fan does not start:

- Check coolant fan and Coolant FC (Fan Control) Control Module -J293-.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Actuating relay for coolant run-on pump 2)

2) only in vehicles with hot-country function

- Press delta button.

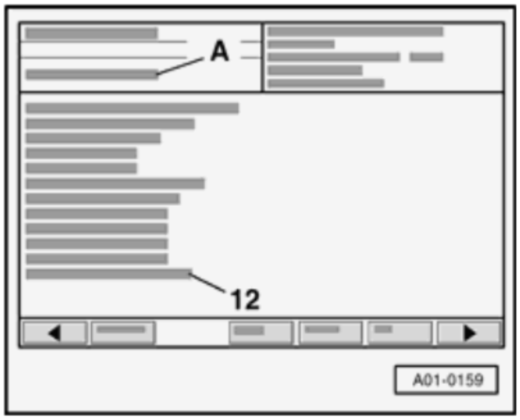

Fig. 28: Display On VAS 5051 - (12th Control Element In Test & Injector - Cyl. 2 -N31-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

12 - Coolant Circulation Pump Relay -J151-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- The Coolant Circulation Pump Relay -J151- switches the pump for coolant run-on on and off at one minute intervals unless the delta button is first pressed to switch to the next control element.

If the after-run coolant pump does not start:

- Check whether hot-country function is coded. Refer to **Login procedure or coding II**.

Actuating injectors

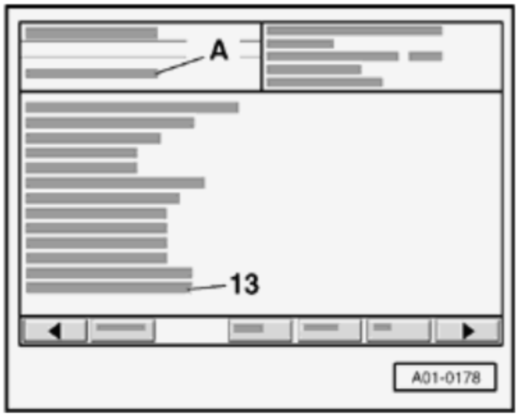

Fig. 29: Display On VAS 5051 - (13th Cylinder 2 Fuel Injector -N31-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

NOTE: The injectors are actuated according to the ignition sequence: cyl. 1, cyl. 4, cyl. 3, cyl. 6, cyl. 2, cyl. 5.

- Press delta button.

A - Control element test waiting: Select next step to continue

13 - Cylinder 1 Fuel Injector -N30-

- Press delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- After pressing the delta button the injector must click five times.

- Use this procedure to check all injectors in sequence.

If one of the injectors is not actuated (does not click):

- Test injectors. Refer to **Fuel injectors, checking**.
- After activating last injector (cylinder 5) press delta button.

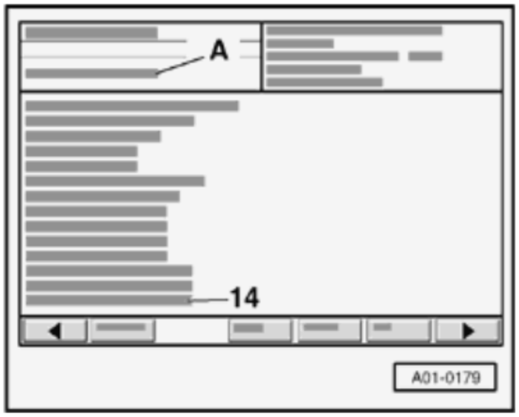

Fig. 30: Display On VAS 5051 - (14th - Cylinder 4 Fuel Injector -N33-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

14 - Cylinder 4 Fuel Injector -N33-

- ○ Click on delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- Fuel injector must click 5 times after delta button is pressed.
- ○ Click on delta button

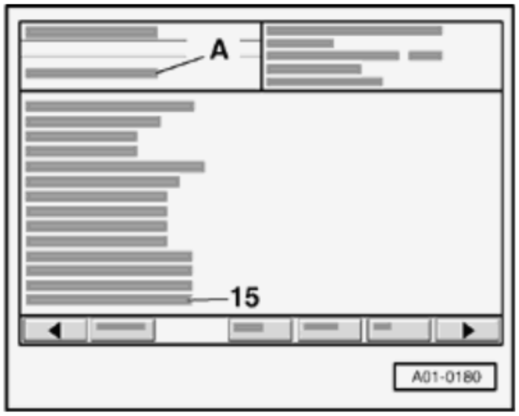

Fig. 31: Display On VAS 5051 - (15th - Cylinder 3 Fuel Injector -N32-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

15 - Cylinder 3 Fuel Injector -N32-

- Click on delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- Fuel injector must click 5 times after delta button is pressed.

- Click on delta button

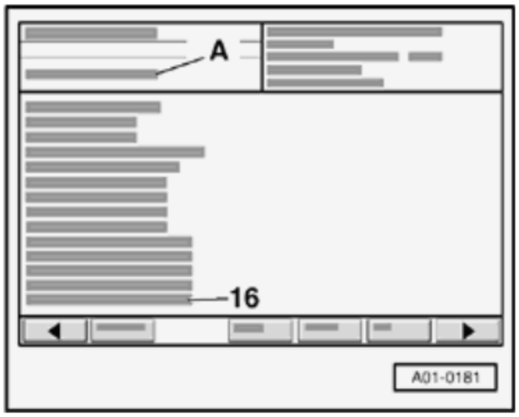

Fig. 32: Display On VAS 5051 - (16th - Cylinder 6 Fuel Injector -N84-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

16 - Cylinder 6 Fuel Injector -N84-

- Click on delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- Fuel injector must click 5 times after delta button is pressed.

- Click on delta button

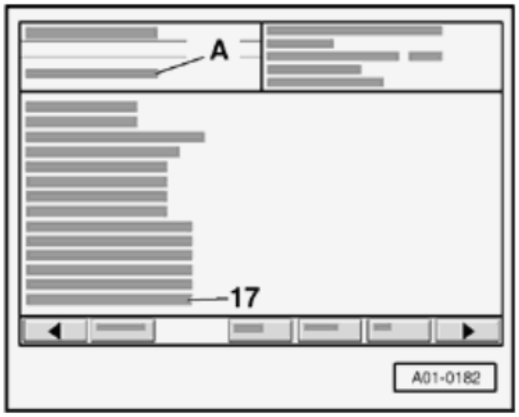

Fig. 33: Display On VAS 5051 - (17th - Cylinder 2 Fuel Injector -N31-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

17 - Cylinder 2 Fuel Injector -N31-

- ○ Click on delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- Fuel injector must click 5 times after delta button is pressed.
- ○ Click on delta button

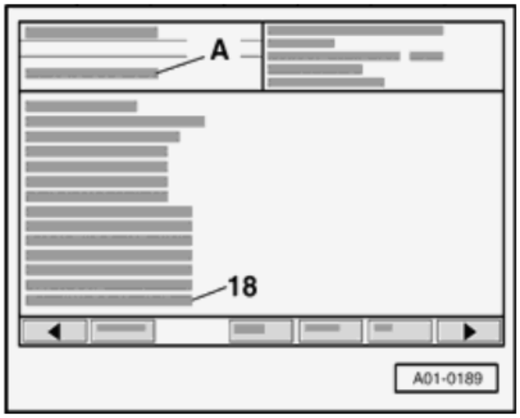

Fig. 34: Display On VAS 5051 - (18th - Cylinder 5 Fuel Injector -N83-)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - Control element test waiting: Select next step to continue

18 - Cylinder 5 Fuel Injector -N83-

- ○ Click on delta button again.

Display on VAS5051:

A - Control element test running: Continuation permitted

- Fuel injector must click 5 times after delta button is pressed.

If one of the fuel injectors is not activated (does not click).

- ○ Check fuel injectors. Refer to **Fuel injectors, checking**.
- ○ Click on delta button

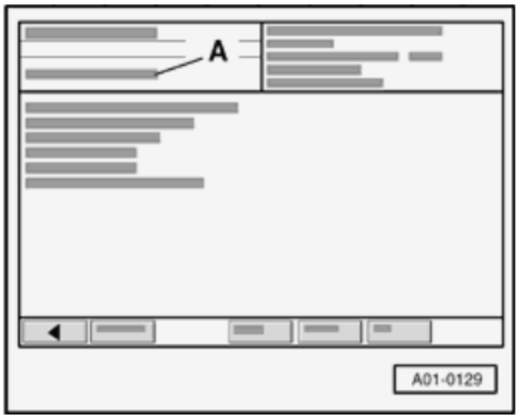

Fig. 35: Display On VAS 5051 - (Output Diagnostic Test Mode Is Completed)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

A - control element test is completed

- ○ Exit function "03 - Final control diagnosis" by pressing <-- button.

NOTE: **Before restarting the Output Diagnosis Test Mode (DTM) the engine must be started and the ignition switched off and on again.**

BASIC SETTING

Basic setting

With engine stopped and ignition switched on, the following operation can be carried out with the function "04 - Basic setting"

- Adaptation of the throttle valve control module to the engine control moduledisplay group 060 (Refer to **Throttle valve control module -J338-, adaptation**)
- Vehicles with automatic transmission: Adaptation of kick down function of accelerator position sensor to engine control module. Refer to Display group 063 (Refer to **Kickdown function, adapting**)

With the engine running, the following operations can be performed with the basic setting function:

- Generation of readiness code (mixture adaptation. Refer to **Readiness code, generating**)
- Performance of mixture preparation system test (Refer to **Vacuum system, checking for leaks** onward)

Test conditions for operations with engine running

- No DTCs stored in DTC memory
- Engine coolant temperature (ECT) at least 80°C.
- Electrical accessories switched off (coolant fan must not run during the test).
- Air conditioning switched off.

- Vehicles with automatic transmission: Selector lever in position P or N.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

or after each required process:

- Start engine.

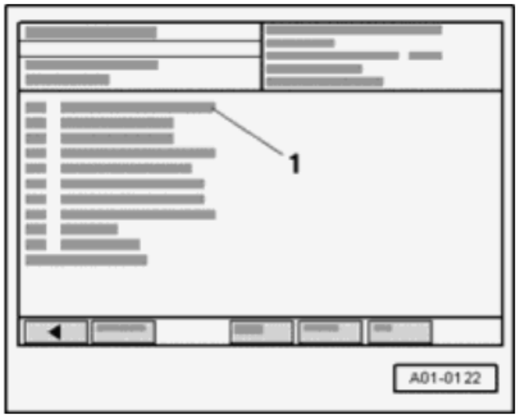

Fig. 36: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

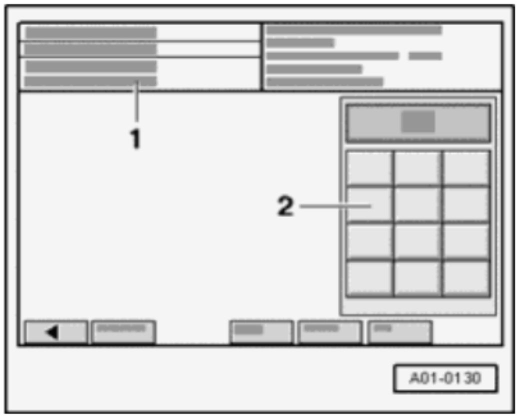

Fig. 37: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter desired display group number (three figures) in zone -2- and confirm entry by pressing -Q- button.

Example:

- Enter "001" for "display group number 001" and confirm entry with -Q- button.

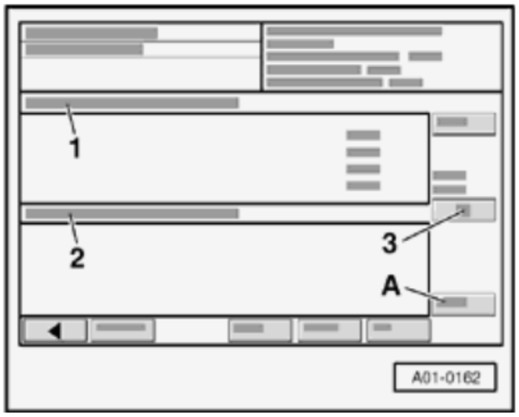

Fig. 38: Identifying Display On VAS 5051 (Measured Values)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Measured values not in basic setting

2 - Measured values in basic setting

3 - Display group X

A - Activate basic setting

NOTE: Basic setting is initiated after pressing the -A- button.

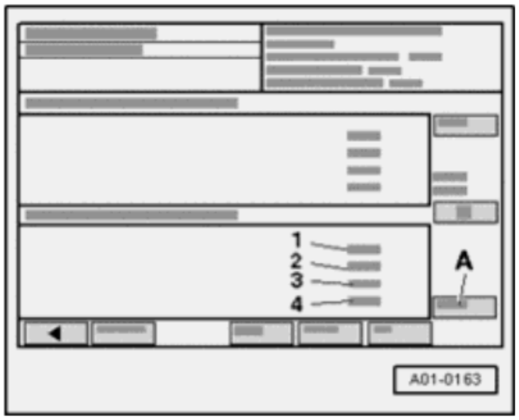

Fig. 39: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Display zone 1

2 - Display zone 2

3 - Display zone 3

4 - Display zone 4

- Exit function "04 - Basic setting" by pressing <-- button.

CONTROL MODULE, CODING

Control module, coding

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

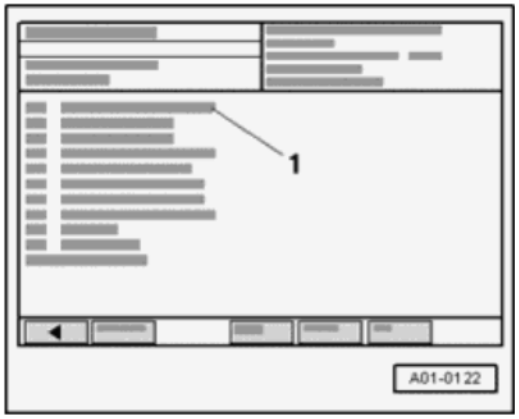

Fig. 40: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "07 - Code control module".

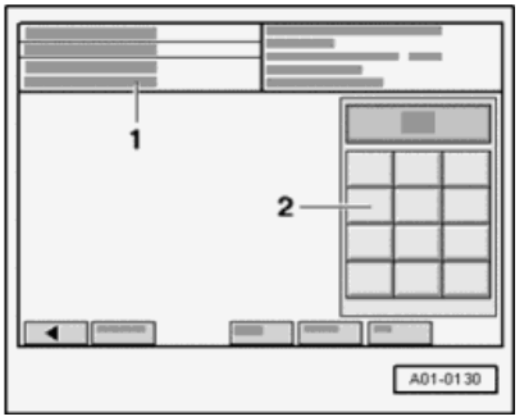

Fig. 41: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter code word

- Enter 7-digit control module code in zone -2- in accordance with coding table. Refer to **Coding table**.

Key to code

XX					Empty characters
	XX				Country/emissions
		X			Drive/auxiliary functions
			X		Transmission

					X	Vehicle type

Example of coding	
0016751	Empty characters, ULEV (emissions regulation), Front Wheel Drive (FWD) with ASR/ESP, 5-Spd. manual transmission, Audi A4

Coding table

Empty Characters	00					
Country/emissions		16				ULEV (emissions regulation)
Drive/auxiliary functions			0			Front-wheel drive without ASR/ESP
			2			AWD without traction control system
			5			Front-wheel drive with ASR/ESP
			7			AWD with traction control system
Transmission				1		6-Speed Manual Transmission
				5		Automatic Transmission 01V
				8		Multitronic 01J
Vehicle type					1	Audi A4

- Confirm entry with -Q- button.

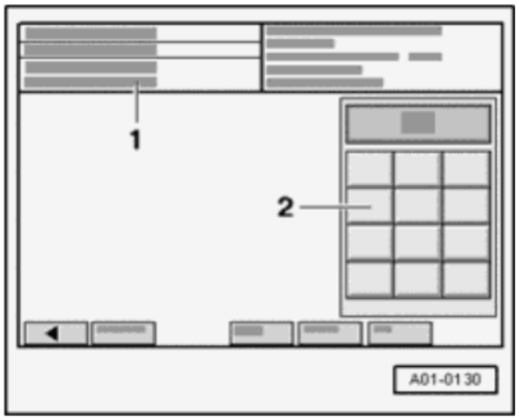

Fig. 42: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Coding is being performed

- Wait until next display appears.

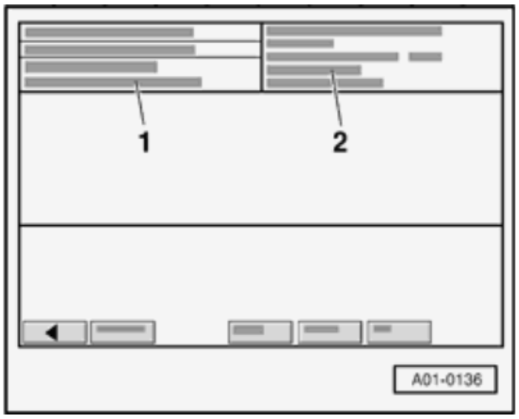

Fig. 43: Diagnostic System VAS 5051: Display - (Coding Of Vehicle System Performed & Control Module Identification With New Coding)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Coding performed in vehicle system

2 - Control module identification with new code

(previous code in brackets)

- Exit function "07 - Coding control module" by pressing <-- button.
- Switch ignition off and then switch on again after 15 seconds.

NOTE:

- **The next time the ignition is switched on the newly entered code will be activated.**
- **If the ignition is not switched off and on after the correct code has been entered, it will not be possible to erase DTC "01044 Control module incorrectly coded").**
- **In the case of non-hot country vehicles, the hot-country function (activation of the pump for coolant run-on) must be deactivated in function 11 - Login, or function 11 - Coding II. Refer to Hot-country function, activating/deactivating after installation of the new control module, a DTC memory entry is made.**

MEASURED VALUE BLOCK, READING

Measured value block, reading

Test requirements:

- Engine coolant temperature at least 80°C.
- Electrical accessories switched off (coolant fan must not run during the test).
- Air conditioning switched off.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

or after each required process:

- Start engine.

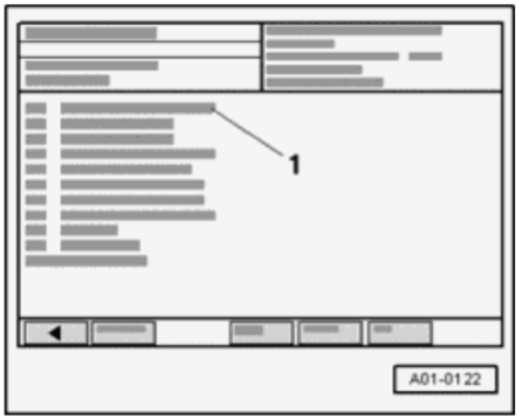

Fig. 44: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

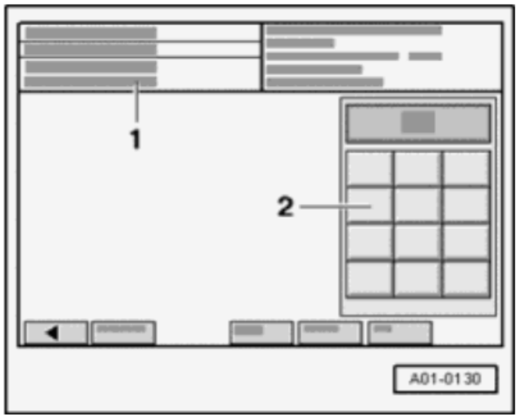

Fig. 45: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group: max. input value = 255

- Enter desired display group number (three figures) in zone -2- and confirm entry by pressing -Q- button.

NOTE: The choice of display group depends on the particular functions and components to be tested.

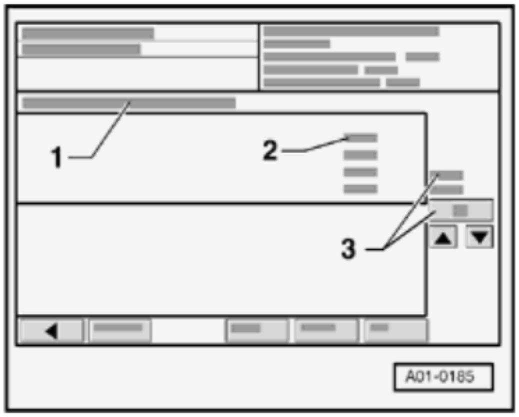

Fig. 46: Diagnostic System VAS 5051: Display Zones
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Read Measured Value Block

2 - Display zone 1

Display zone 2

Display zone 3

Display zone 4

3 - Display group X

- Exit function "08 - Read measured value block" by pressing <-- button.

NOTE:

- **If no display follows, a display field is not assigned.**
- **To switch to a different display group, proceed as follows:**

Display group	VAS5051 tester
Higher	Press s button.
Lower	Press t button.

- Press <-- button to end function "08 - Read measuring value block".

ADAPTATION

Adaptation

NOTE:

- **The idling speed can be decreased or increased by using the "Adaptation" function, channel 01.**
- **Only perform the idling speed adaptation described in the following: in order to eliminate vibration noises or they are the cause of a customer complaint.**

Procedure

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

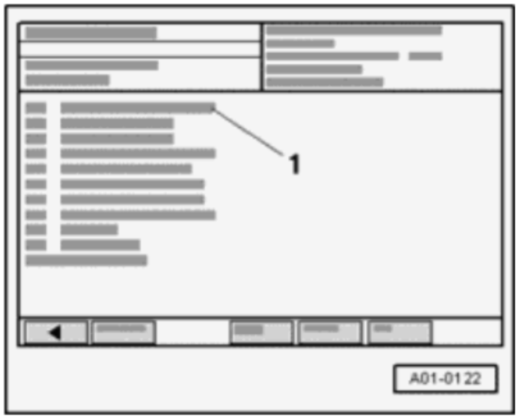

Fig. 47: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "10 - Adaptation".

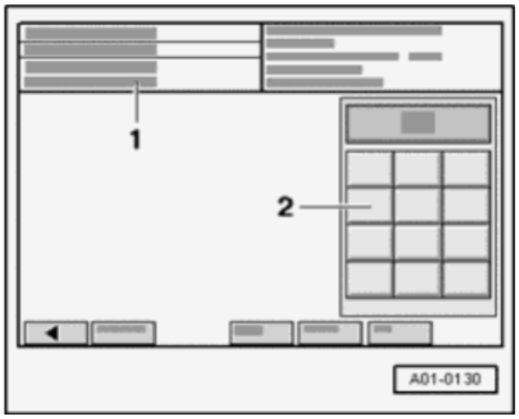

Fig. 48: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter channel number

- Enter "01" for "Adaptation channel 011" and confirm by pressing -Q- button.

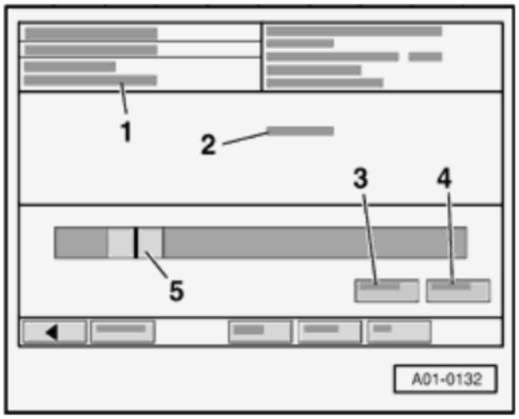

Fig. 49: Diagnostic System VAS 5051: Display - Channel 21 Read And Test, 17-Digit VIN, Old Number Of Keys, Sliding Bar
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Read out and test

Channel X

2 - Display text of selected channel

or

No display

5 - The scroll bar indicates the current adaptation value

NOTE:

- **Adaptation value 128 is the factory-set idling speed,**
- **Adaptation can be performed by moving the scroll bar. Refer to A - Changing adaptation value using scroll baror by simply entering the new adaptation value. Refer to B - Adaptation by direct entry.**

A - Changing adaptation value using scroll bar

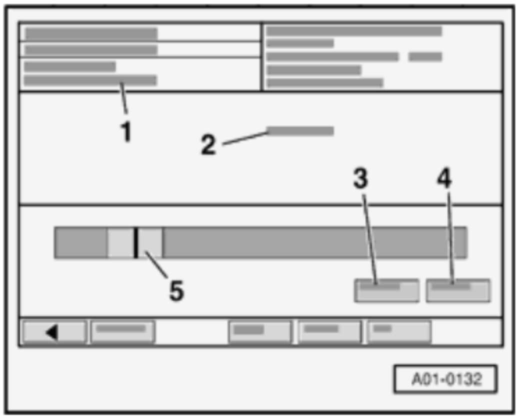

Fig. 50: Diagnostic System VAS 5051: Display - Channel 21 Read And Test, 17-Digit VIN, Old Number Of Keys, Sliding Bar
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Move scroll bar -5- in desired direction or click on area next to scroll bar, which will move it in desired direction.
- Press "Save" button -4-.

	Engine speed increase							
Adaptation value	00129	00130	00131	00132	00133	00134		
Engine speed in steps	+10 RPM	+20 RPM	+30 RPM	+40 RPM	+50 RPM	+60 RPM		
	Engine speed decrease							
Adaptation value	00127	00126	00125	00124	00123	00122	00121	00120
Engine speed in steps	-10 RPM	-20 RPM	-30 RPM	-40 RPM	-50 RPM	-60 RPM	-70 RPM	-80 RPM

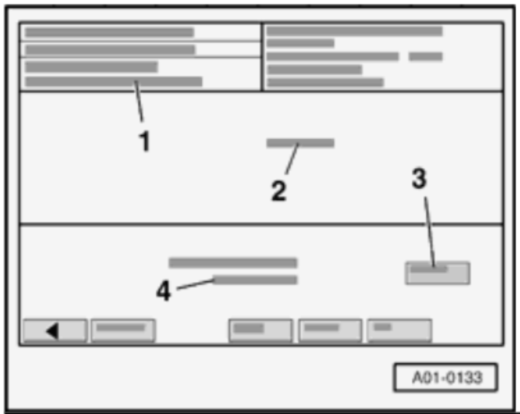

Fig. 51: Diagnostic System VAS 5051: Display - Channel 50 Save, 17-Digit VIN And Original Value
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Save channel X

2 - Display text of selected channel

or

No display

4 - Original value X

New value X

- Confirm new adaptation value by pressing "Accept" button -3-.

Fig. 52: Diagnostic System VAS 5051: Display - Channel 21
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Channel X

Value X stored

- Exit function "10 - Adaptation" by pressing <-- button.

NOTE: **An engine speed decrease follows immediately, an increase in engine speed is only effective after briefly pressing the accelerator pedal.**

B - Adaptation by direct entry

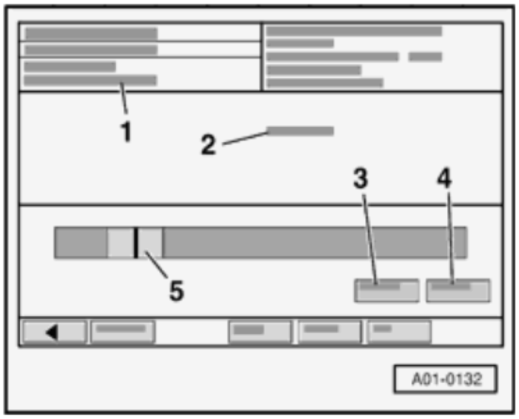

Fig. 53: Diagnostic System VAS 5051: Display - Channel 21 Read And Test, 17-Digit VIN, Old Number Of Keys, Sliding Bar
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Press "Keypad" button -3-.

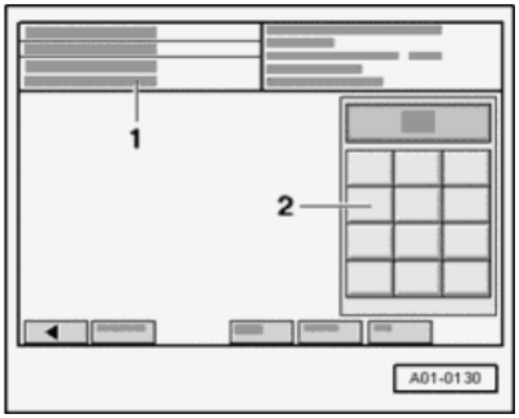

Fig. 54: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter adaptation value

- Enter desired 5-digit adaptation value in zone -2- and confirm entry by pressing -Q- button.

	Engine speed increase							
Adaptation value	00129	00130	00131	00132	00133	00134		
Engine speed in steps	+10 RPM	+20 RPM	+30 RPM	+40 RPM	+50 RPM	+60 RPM		

	Engine speed decrease							
Adaptation value	00127	00126	00125	00124	00123	00122	00121	00120
Engine speed in steps	-10 RPM	-20 RPM	-30 RPM	-40 RPM	-50 RPM	-60 RPM	-70 RPM	-80 RPM

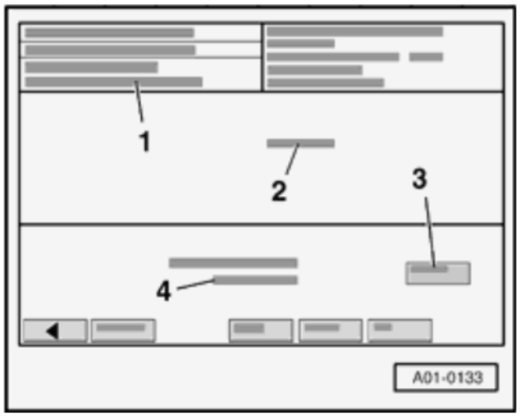

Fig. 55: Diagnostic System VAS 5051: Display - Channel 50 Save, 17-Digit VIN And Original Value
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Save

Channel X

2 - Display text of selected channel

or

No display

4 - original value X

New value X

- Confirm new adaptation value by pressing "Accept" button -3-.

Fig. 56: Diagnostic System VAS 5051: Display - Channel 21
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Channel X

Value X saved

- Exit function "10 - Adaptation" by pressing <-- button.

NOTE: **Immediately following an engine speed decrease, an increase in engine speed is only effective after briefly pressing the accelerator pedal.**

LOGIN PROCEDURE OR CODING II

Login procedure or coding II

With engine stopped and ignition switched on, the following operations can be carried out with the function "11 - Login, or function 11 - Coding II:

- Activation and deactivation of the cruise control system (CCS). Refer to **Cruise control system, activating/deactivating**
- Activation and deactivation of the hot-country function (coolant run-on pump for hot countries). Refer to **Hot-country function, activating/deactivating**

Cruise control system, activating/deactivating

NOTE:

- **Vehicles equipped with CCS, the CCS function must be activated after replacement of the engine control module.**
- **If the CCS function is activated in the engine control module of a vehicle without CCS, a DTC memory entry is made. If this is the case, the CCS function must be deactivated.**

Procedure

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

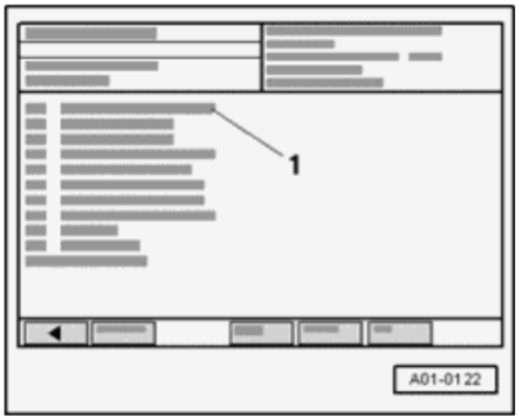

Fig. 57: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "11 - Coding II".

All models

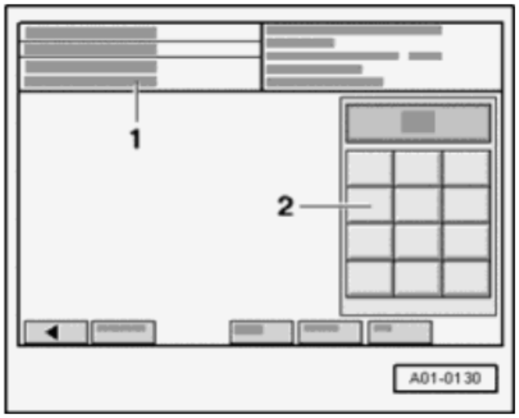

Fig. 58: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter code word

Activate CCS

- Enter "11463" in zone -2- and confirm entry by pressing -Q- button.

Deactivate CCS

- Enter "16167" in zone -2- and confirm the entry by pressing -Q- button.
- Exit function "11 - Login, or function 11 - Coding II" by pressing <-- button.

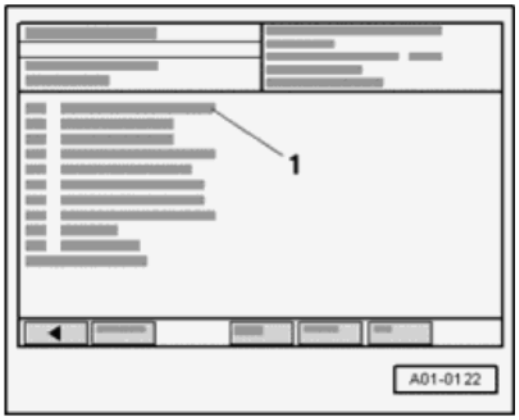

Fig. 59: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

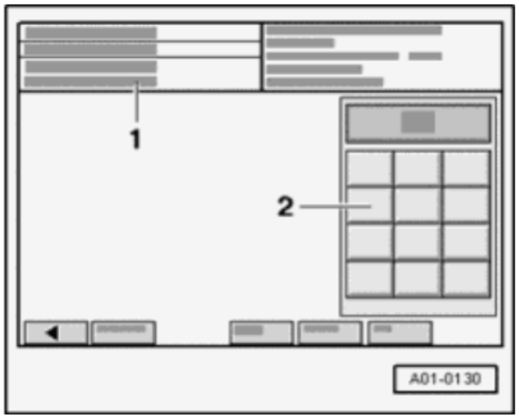

Fig. 60: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "066" for "display group number 066" in zone -2- and confirm entry by pressing -Q- button.

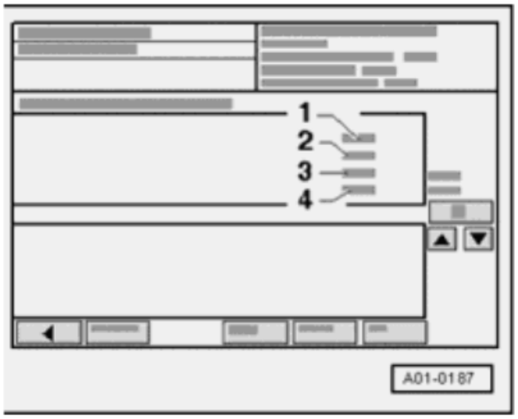

Fig. 61: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -2-.

	Display zones			
	1	2	3	4
Display group 066: Signals to engine control module				
Display	xxx km/h	**XXXXXXXX**	xxx km/h	XXXXXXXX
Display	ACTUAL speed	**Switch settings**	SPECIFIED speed	Switch settings
Range		**0 = off** **1 = on**		0 = off 1 = on
Specified value		**XXXX0XXX (if CCS not activated)**		XXXXXXXX
		XXXX1XXX (if CCS activated)		
	Value: **X = no meaning**			

- Exit function "08 - Read measured value block" by pressing <-- button.
- Press "06 - End output".
- Switch ignition off.

Hot-country function, activating/deactivating

NOTE:

- **Vehicles for hot countries are equipped with a coolant run-on pump which is actuated by the engine control module.**
- **In the case of non-hot country vehicles, the hot-country function must be deactivated after installation of a new control module, as otherwise a fault memory entry is made.**

Procedure

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

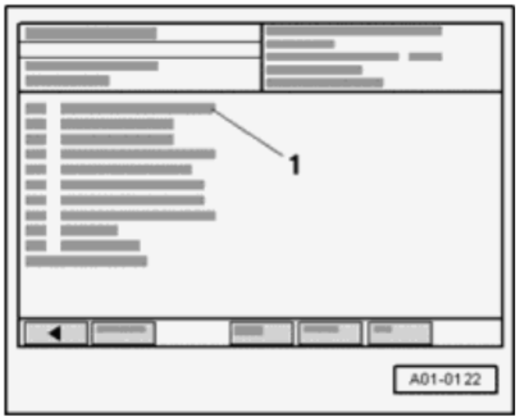

Fig. 62: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "11 - Coding II".

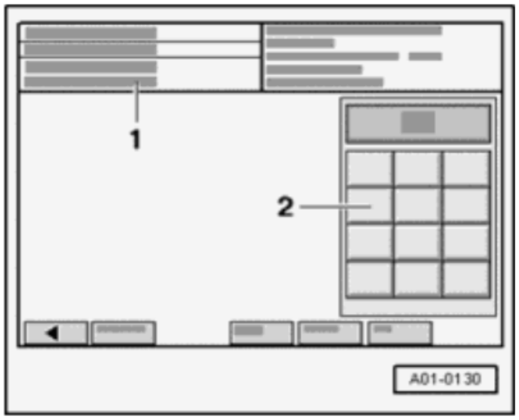

Fig. 63: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter code word

Deactivating hot-country function

- Enter "50000" for "deactivate hot-country function" in zone -2- and confirm by pressing -Q- button.

Activating hot-country function

- Enter "60000" for "activate hot-country function" in zone -2- and confirm by pressing -Q- button.
- Exit function "11 - Login, or function 11 - Coding II" by pressing <-- button.

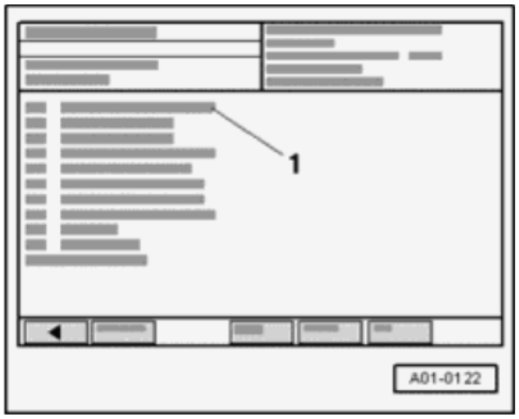

Fig. 64: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

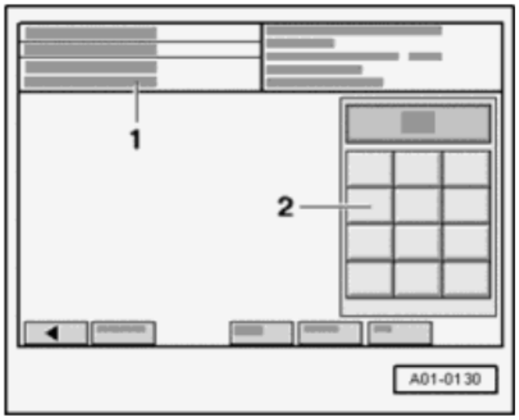

Fig. 65: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Press buttons -1-, -3-, and -2- for "display group number 132" in zone -2- and confirm entry by pressing -Q- button.

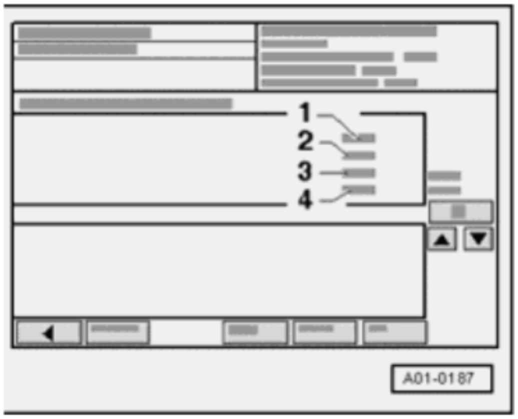

Fig. 66: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -4-.

	Display zones			
	1	2	3	4
Display group 132: Cooling				
Display				**XXXXXXXX**
Display				**Cooling status**
Range				**0 = off** **1 = on**
Specified value				**0XXXXXXX (for hot-country function deactivated)**
				1XXXXXXX (for hot-country function activated)
				Value: **X = no meaning**

- Exit function "08 - Read measured value block" by pressing <-- button.
- Press "06 - End output".
- Switch ignition off.

READINESS CODE

Readiness code

The readiness code appears as an 8-digit display on measured value block 086, display zone 1. Each of the 8 digits is allocated to a particular emission-related system.

The function of each of these systems is checked by the On Board Diagnostic (OBD) and the relevant position for the system in the 8-digit display is changed from "1" to "0" in a test sequence which must be fully completed.

The readiness code produced after successful completion of the test sequence is then "0 0 0 0 0 0 0 0" (measured value block 086, display zone 1).

If an individual test has been completed, but is "not OK", a DTC is entered in the DTC memory. Checking Diagnostic Trouble Code (DTC) memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .

The readiness code is set to "1 1 1 0 0 1 0 1" if:

- The DTC memory has been erased.
- The voltage supply to the engine control module has been interrupted (e.g. the connector detached, battery disconnected).
- A new engine control module has been installed.

In this case the readiness code must be reproduced. Refer to **Readiness code, generating** .

NOTE: **When driving with varying loads the exhaust tests are initiated by the control module and the readiness code generates itself. In this case the concluding control is possibly omitted, i.e. it is not obvious whether the vehicle was handed over to the customer without any malfunctions.**

Reading readiness code

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Engine must be running at idling speed.

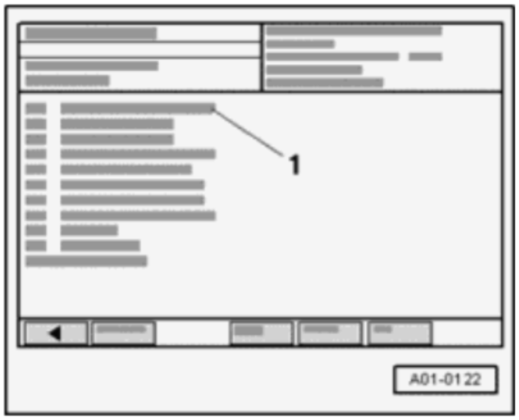

Fig. 67: Diagnostic System VAS 5051: Display

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

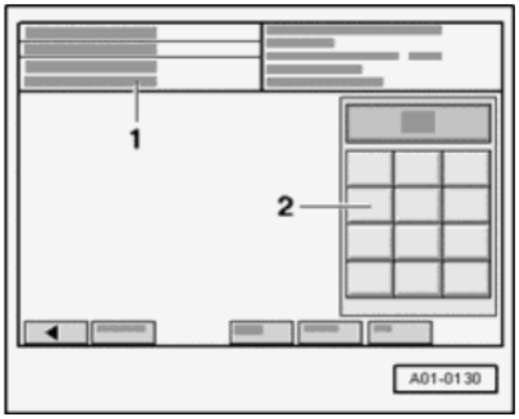

Fig. 68: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "086" for "display group number 086" in zone -2- and confirm entry by pressing -Q- button.

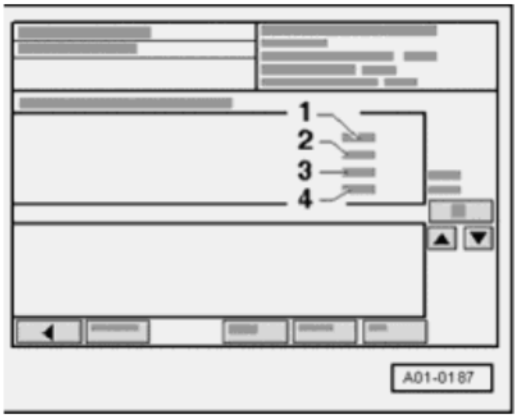

Fig. 69: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -1-.

- Specified value: 0 0 0 0 0 0 0 0

	Display zones			
	1	2	3	4
Display group 086: Readiness code				
Display	**0 0 0 0 0 0 0 0**	X X X X X X X X	X X X X X X X X	**X X X X X X X X**
Display	**Ready bits Completed tests**	Individual tests performed	Individual tests performed	Individual tests performed
Range	**1 = not completed** **0 = completed**	1 = not completed 0 = completed	1 = not completed 0 = completed	1 = not completed 0 = completed
Specified value	**0 0 0 0 0 0 0 0**	X X X X X X X X	X X X X X X X X	X X X X X X X X
Explanation of readiness code. Refer to **Reading readiness code**				

Note on display zone 1:

Display zone 1 is the most important. This display indicates which system has been checked by the On Board Diagnostic (OBD) since the last time the DTC memory was erased or since installation of a new control module. After erasing the DTC memory, all testable values are set to "1" and then to "0" after successful completion of the test.

X	**X**	**X**	**X**	**X**	**X**	**X**	**X**	Notes on display group 086, display zone 1
								Catalytic converter diagnosis - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code. Refer to **Readiness code, generating**
								Display always 0
								Evaporative Emission (EVAP) system - Display 0 =

									Test was carried out • Display 1 = Test was not carried out (produce readiness code. Refer to **Readiness code, generating**)
									Secondary air system • Display 0 = Test was carried out • Display 1 = Test was not carried out (produce readiness code. Refer to **Readiness code, generating**)
									Display always 0
									Oxygen sensors • Display 0 = Test was carried out • Display 1 = Test was not carried out (produce readiness code. Refer to **Readiness code,**

								generating)
								Oxygen sensor heating - Display 0 = Test was carried out - Display 1 = Test was not carried out (produce readiness code. Refer to **Readiness code, generating**)
								Display always 0

NOTE: The readiness code is only produced when all display digits in display zone 1 are set to "0".

If the specification "0 0 0 0 0 0 0 0" is achieved in display zone 1:

- Press <-- button.

If specified value is not obtained:

- Generate readiness code. Refer to **Readiness code, generating**.

Readiness code, generating

Requirements

- Vehicle stationary.
- Vehicles with automatic transmission: Selector lever in position P or N.
- Electrical accessories switched off (coolant fan must not run during the test).
- Air conditioning switched off.

- Engine coolant temperature (ECT) at least 80°C. Refer to display group 004, display zone 3). Important: Warm up engine by means of a road test.
- Engine control module version checked: Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions**. Operation 9: Refer to **Operation 9: Diagnosis of tank seal and oxygen sensor interchange recognition behind catalytic converter**, requires different procedures

depending on ECM Part No./software version number.

NOTE: **If the test result is immediately displayed as "OK" after selecting a display group during an operation, the test has already been performed and you can continue with the next operation.**

Operation 1: Checking DTC memory

Test conditions

- Engine stopped, ignition switched on

- ○ Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Ignition must be switched on.

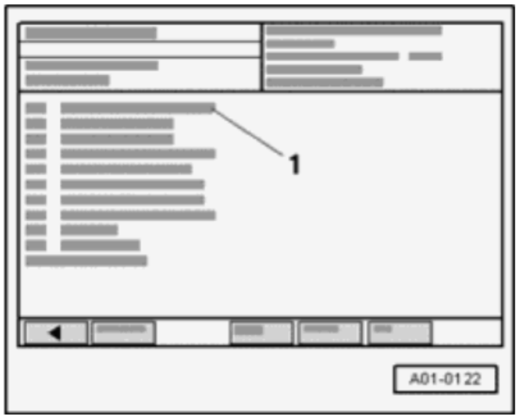

Fig. 70: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- ○ Under -1- select diagnostic function "02 - Check DTC memory".

Fig. 71: Identifying Content Of DTC Memory & Identification Of Fault On Diagnostic System VAS 5051 Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Contents of fault memory:

0 Faults recognized

or

X Faults recognized

2 - Fault

Fault code

Fault location

Fault type

If a fault is stored:

- Repair malfunction and erase DTC memory. Perform a road test and check DTC memory again.

If no DTC is stored:

- Press <-- button.
- Perform next operation.

Operation 2: Erase DTC memory

Test conditions

- Engine stopped, ignition switched on

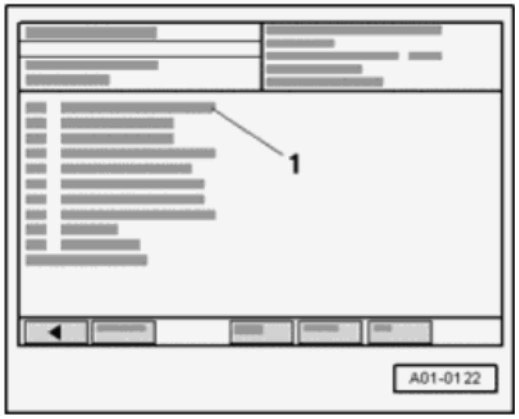

Fig. 72: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "05 - Erase DTC memory".

NOTE: The readiness code is reset when the DTC memory is erased and must be reproduced.

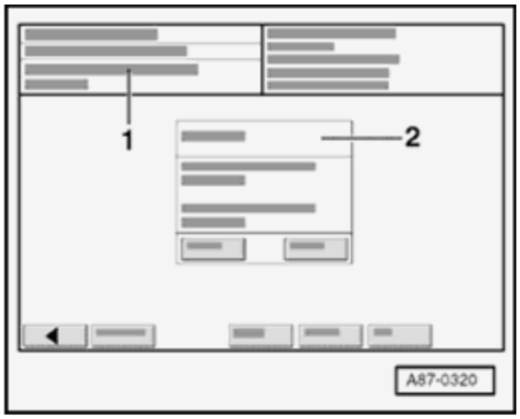

Fig. 73: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - No display (before erasing)

or

DTC memory erased

NOTE: Should the function be carried out?

Will be erased!

- Press "OK"button in display -2-.
- Press <-- button.
- Perform next operation.

Operation 3: Adapting the throttle valve control module to the engine control module

Test conditions

- Engine stopped, ignition switched on

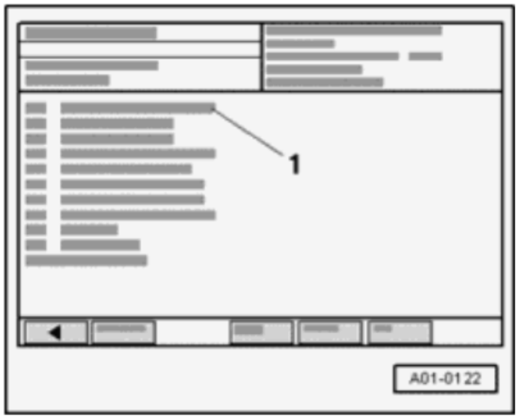

Fig. 74: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

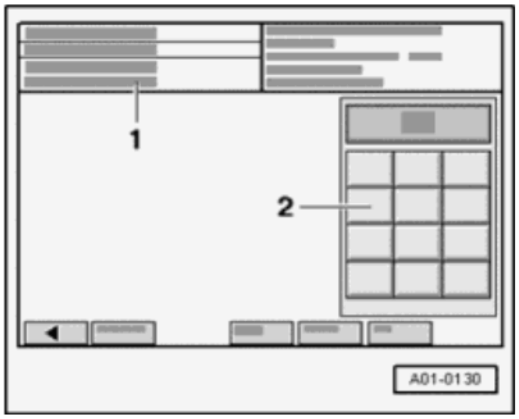

Fig. 75: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "060" for "display group number 060" in zone -2- and confirm entry by pressing -Q- button.

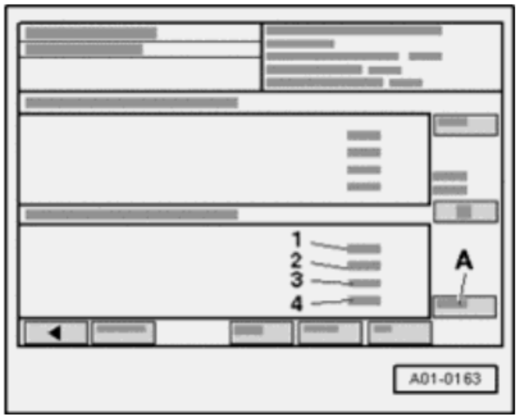

Fig. 76: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check indication in display fields -3- and -4-.

	Display zones			
	1	2	3	4
Display group 060: Adaptation of throttle valve control module				
Display	xx%	xx%	**x**	**---**
Display	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Adaptation stage counter**	**Adaptation status**
Range			**0 to 8**	**ADP process running** **ADP OK** **ERROR**
Specif. value	3 to 93%	9 to 3%	**8**	**ADP OK**
			The adaptation stage counter reaches the number 8 after adaptation (some numbers may also be skipped).	If "ERROR" is displayed: Interrogate fault memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** . If specified value is not obtained: Note. Refer to **Throttle**

				Valve Control Module -J338-, adapting

Note on display zone 3:

During adaptation, various digits are displayed in display zone 3 which represent the relevant adaptation status. The most crucial factor is not the way in which the adaptation stage counter (display zone 3) behaves during the adaptation process, but that the specification "ADP OK" is displayed after adaptation in display zone 4.

If specification "ADP OK" is obtained:

- Press <-- button.
- Perform next operation.

Operation 4: Adapting kick down functionl

1) Only on vehicles with automatic transmission.

Test conditions

- Engine stopped, ignition switched on

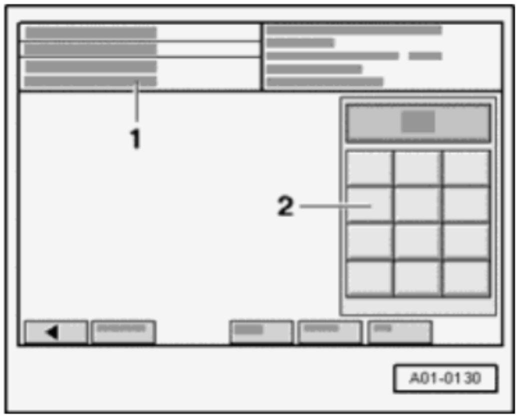

Fig. 77: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "063" for "display group number 063" in zone -2- and confirm entry by pressing -Q- button.

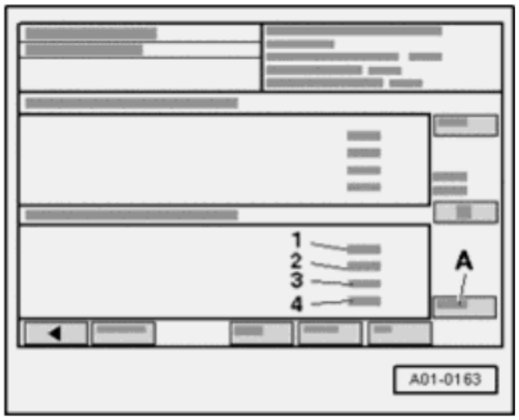

Fig. 78: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.

NOTE: You will now be instructed to: "Operate kick down".

- Fully depress accelerator pedal beyond kickdown point and keep it pressed.

NOTE: During the kickdown point adaptation process, "Kickdown ADP running" is shown on the display. After successful adaptation of the kickdown point "Kickdown ADP OK" appears on the display.

- Check indication in display field -4-.

	Display zones			
	1	2	3	4
Display group 063: Adapting kickdown function				
Display	xx%	xx%	**Kick down**	**---**
Display	Sensor 1 for Accelerator pedal position	Adapted kick down value sensor 1 for accelerator pedal position.	**Kick down**	**Adaptation status**
Range			**Kick down**	**Starting** **ADP process running** **ADP OK** **ERROR**
Specif. value	79 to 94%	79 to 94%	**Kick down**	**ADP OK**
				If "ERROR" is displayed:

				Interrogate fault memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .

Note on display zone 4:

If "ERROR" can be displayed, if e.g. accelerator pedal is not pressed when instructed by tester, or if accelerator pedal was released while adaptation was already running but process was not yet complete. In both cases it is necessary to exit the "Basic setting" mode and restart the adaptation process.

If specification "ADP OK" is obtained:

- Press <-- button.
- Perform next operation.

Operation 5: Checking operating status of oxygen sensor control

- Start engine (for vehicles with manual transmission: press clutch pedal).

NOTE: **If necessary, after the engine starts reselect vehicle system "01 - Engine electronics" and diagnostic function "04 - Basic setting".**

Test conditions

- Engine running at idling speed

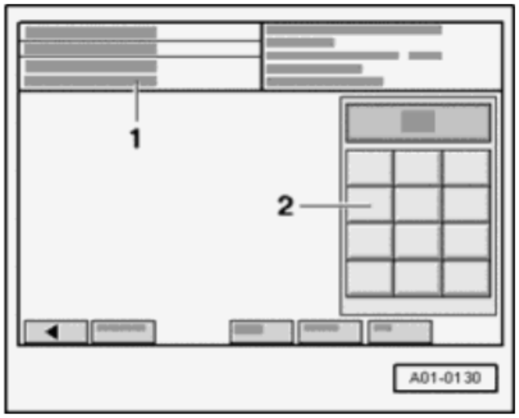

Fig. 79: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

Max. input value = 255

- Enter "030" for "display group number 030" in zone -2- and confirm entry by pressing -Q- button.

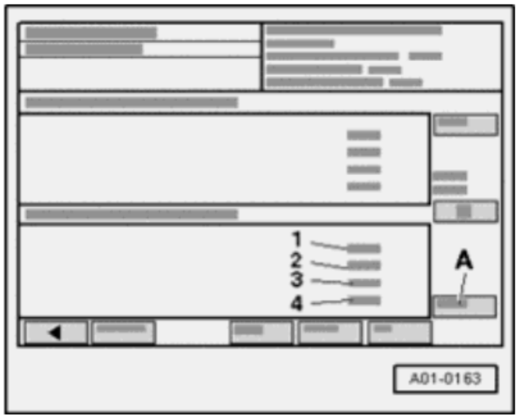

Fig. 80: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check indication in display fields -1- to -4-.

NOTE:

- **By increasing the engine speed the specified values are achieved more quickly.**
- **The "oxygen sensor status" indicates the condition of the oxygen sensor control and the oxygen sensors.**

	Display zones			
	1	2	3	4
Display group 030: Oxygen sensor status				
Display	**X X X X X**	**X X X X**	**X X X X X**	**X X X X**
Display	**Oxygen sensor status, Bank 1, Sensor 1**	**Oxygen sensor status, Bank 1, Sensor 2**	**Oxygen sensor status, Bank 2, Sensor 1**	**Oxygen sensor status, Bank 2, Sensor 2**
Range	**0 = off** **1 = on**	**0 = off** **1 = on**	**0 = off** **1 = on**	**0 = off** **1 = on**
Specif. value	**1 1 1**	**1 1 0**	**1 1 1**	**1 1 0**

Significance of last 3 digits in readout of display group 030			
X	X	X	**Display zones 1...4**

X			Condition of oxygen sensor heating: 0 = not active; 1 = active
	X		Oxygen sensor condition: 0 = not active; 1 = active
		X	Oxygen sensor (O2S) control 0 = not active; 1 = active

NOTE:

- **The first digit of the relevant 3-digit display (heating) fluctuates between 0 and 1.**
- **The oxygen sensor control for oxygen sensor behind catalytic converter (Bank 1, Sensor 2 and Bank 2, Sensor 2) is not active without engine load, i.e. the last digit of the 3-digit display is 0.**

- Continue test when displays have achieved "111" in display zones 1 and 3 and "110" in display zones 2 and 4.
- Press <-- button.
- Perform next operation.

Operation 6: Diagnosis of oxygen sensor aging before catalytic converter

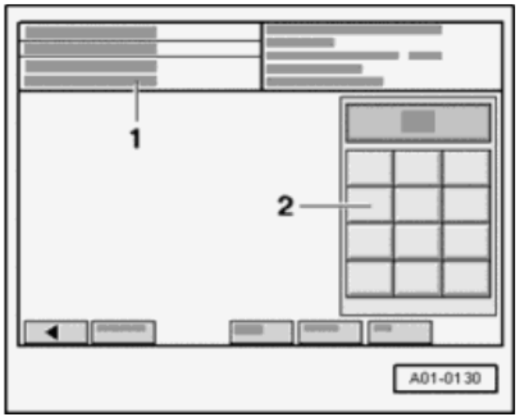

Fig. 81: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

Max. input value = 255

- Enter "197" for "display group 197" in zone -2- and confirm entry by pressing -Q- button.

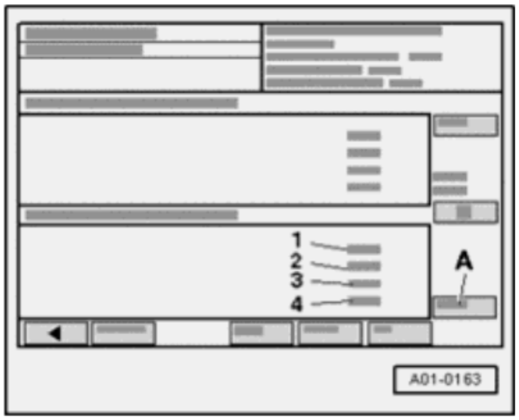

Fig. 82: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Press accelerator and brake pedal simultaneously. Engine speed increases to approx. 2200 RPM.

Test conditions

- Accelerator and brake pedal pressed simultaneously, engine runs at approx. 2200 RPM.

- Check specification in display zone -4-.
- Check indication in display fields -2- and -4-.

	Display zones			
	1	2	3	4
Display group 197: Diagnostic of oxygen sensor aging (Bank 1, Sensor 1 - Bank 2, Sensor 1)				
Display	x.x	---	x.x	---
Display	Dynamic factor Bank 1, Sensor 1	Diagnosis status	Dynamic factor Bank 2, Sensor 1	Diagnosis status
Range		Test OFF Test ON B1-S1 OK B1-S1 NOK		Test OFF Test ON B2-S1 OK B2-S1 NOK
Specif. value		**B1-S1 OK**		**B2-S1 OK**
Note:		If "B1-S1 NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .		If "B2-S1 NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .

If specified values "B1-S1 OK" and "B2-S1 OK" are obtained:

- Press <-- button.

Operation 7: Diagnosis of oxygen sensor operational readiness behind catalytic converter

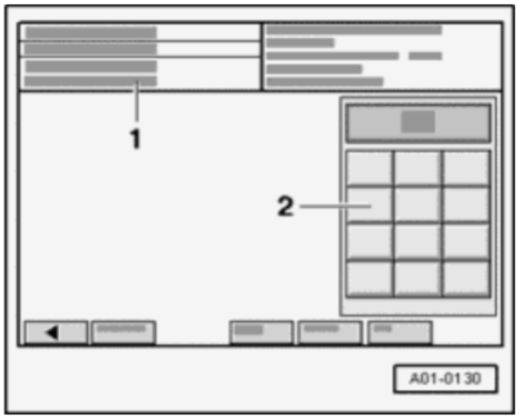

Fig. 83: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "193" for "display group number 193" in zone -2- and confirm entry by pressing -Q- button.

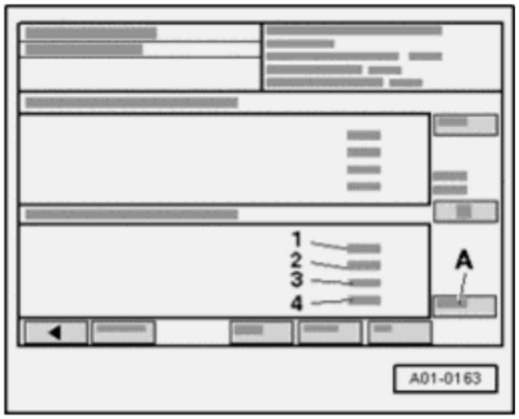

Fig. 84: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Press accelerator and brake pedal simultaneously. Engine speed increases to approx. 2200 RPM.

Test conditions

- Accelerator and brake pedal pressed simultaneously, engine runs at approx. 2200 RPM.
  - Check indication in display fields -2- and -4-.

	Display zones			
	1	2	3	4
Display group 193: Operational readiness of oxygen sensors (Bank 1, Sensor 2 and Bank 2, Sensor 2)				
Display	x.xxx V	---	x.xxx V	---
Display	Oxygen sensor voltage Bank 1, Sensor 2	**Diagnosis status**	Oxygen sensor voltage Bank 2, Sensor 2	**Diagnosis status**
Range		**Test OFF** **Test ON** **B1-P2 OK** **B1-P2 NOK**		**Test OFF** **Test ON** **B2-P2 OK** **B2-P2 NOK**
Specif. value	0.100 to 0.950 V	**B1-P2 OK**	0.100 to 0.950 V	**B2-P2 OK**
Note:		If "B1-S2 NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking**		If "B2-S2 NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking**

If specification "B1-S2 OK" and "B2-S2 OK" are obtained:

- Press <-- button.
- Perform next operation.

Operation 8: Diagnosis of tank ventilation valve

Test requirement

- Engine running at idle.

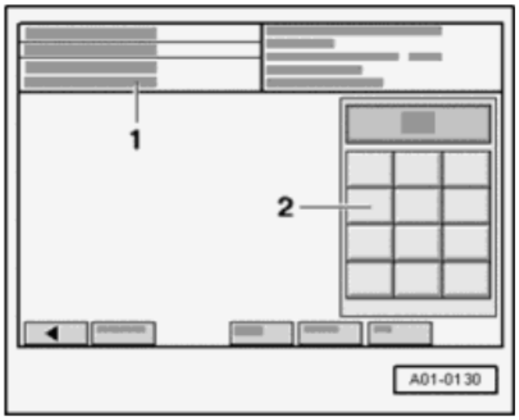

Fig. 85: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "195" for "display group number 195" in zone -2- and confirm entry by pressing -Q- button.

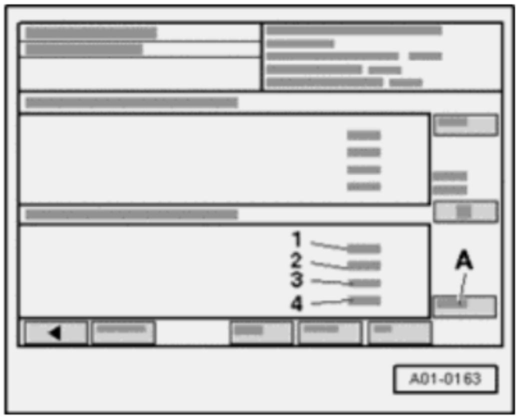

Fig. 86: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check indication in display field -4-.

	Display zones			
	1	2	3	4
Display group 195: Diagnosis of tank ventilation valve				
Display	xx%	xx%	xx%	---
Display	Percent open, tank	Oxygen sensor	Idle control	Diagnosis status

	ventilation valve	control Diagnostic value	Deviation	
Range				**Test OFF** **Test ON** **TVV OK** **TVV NOK** **Abort**
Specif. value	0 to 99%			TEV i.O.
				If "TVV NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** . Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking**

If specification "Syst. OK" is obtained:

- Press <-- button.

Operation 9: Diagnosis of tank seal and oxygen sensor interchange recognition behind catalytic converter

Test conditions

For ECM up to Part No. 8E0 909 559D, software version D0003:

- Engine running at idling speed

For ECM Part No. 8E0 909 559D, from software version D0004 and ECM 8E0 909 559E, from software version D0001:

- Accelerator and brake pedals fully pressed simultaneously and held in this position until a test result is displayed

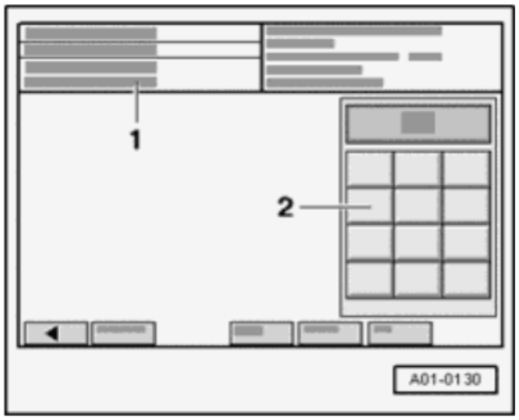

Fig. 87: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "196" for "display group number 196" in zone -2- and confirm entry by pressing -Q- button.

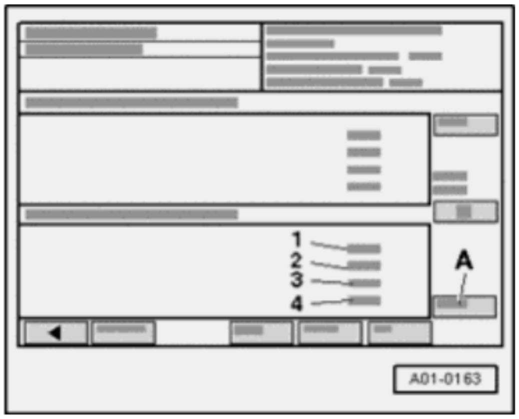

Fig. 88: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check indication in display fields -1- and -4-.

NOTE:

- **Tank leak diagnostic lasts longer than the oxygen sensor interchange recognition.**
- **In case diagnostic leak test is not started, open fuel filler cap briefly (to release pressure).**

CAUTION:

- **Depending on the software status of the ECM, the engine should be running in idle or with increased RPM for interchange recognition.**
- **If the interchange recognition does not start in display field 4, press down on the accelerator and brake pedals simultaneously. This increases the engine speed to approx. 1500 RPM and starts the test.**

	Display zones			
	1	2	3	4
Display group 196: Tank leak diagnosis and oxygen sensor interchange recognition (Bank 1, Sensor 2 - Bank 2, Sensor 2)				
Display	xxxx RPM	xxx°C	x.xxx V	**---**
Display	Diagnosis status Tank leak	Oxygen sensor voltage Bank 1, Sensor 2	Oxygen sensor voltage Bank 2, Sensor 2	Diagnosis status Oxygen sensor activation
Range	Test OFF Test ON Syst. OK Syst. NOK			**Test OFF** **Test ON** **Syst. OK** **Syst. NOK**
Specified value	Syst. OK	0.100...0.950 V	0.100...0.950 V	Syst. OK
Note:	If "Syst. NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking**			**If "Syst. NOK" is displayed: Check routing of oxygen sensor wires**

If the specified value "Syst. OK" is obtained:

- Press <-- button.
- Perform next operation.

Operation 10: Diagnosis of oxygen sensor aging behind catalytic converter

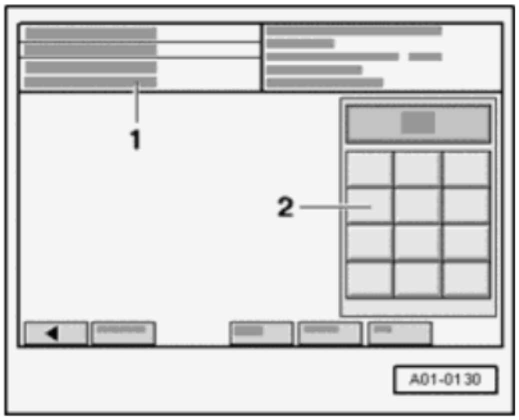

Fig. 89: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "194" for "display group number 194" in zone -2- and confirm entry by pressing -Q- button.

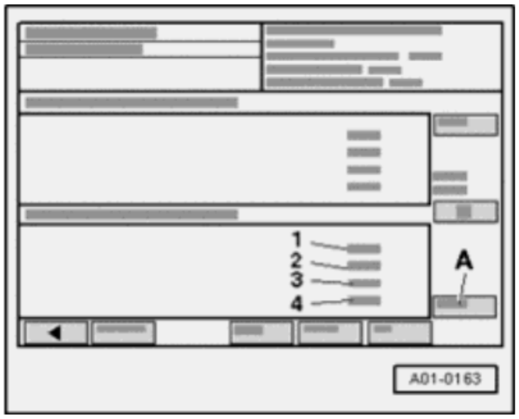

Fig. 90: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Press accelerator and brake pedal simultaneously, engine speed increases to approx. 2200 RPM.

Test conditions

- Accelerator and brake pedal pressed simultaneously, engine runs at approx. 2200 RPM.

  - Check indication in display fields -3- and -4-.

	Display zones			
	1	2	3	4
Display group 194: Diagnosis of oxygen sensor aging (Bank 1, Sensor 2 - Bank 2, Sensor 2)				
Display	xxxx RPM	xxx°C	**---**	**---**
Display	Engine speed	Exhaust gas temperature	**Diagnosis status**	**Diagnosis status**
Range			**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 NOK**	**Test OFF** **Test ON** **B2-S2 OK** **B2-S2 NOK**
Specif. value	approx.2200 RPM	Above 350°C	**B1-S2 OK**	**B2-S2 OK**
Note:			If "B1-S2 NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking**	If "B2-S2 NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking**

If the specified values "B1-S2 OK" and "B2-S2 OK" is obtained:

- Press <-- button.

Operation 11: Catalytic converter diagnosis

Test conditions

- Engine running at idling speed

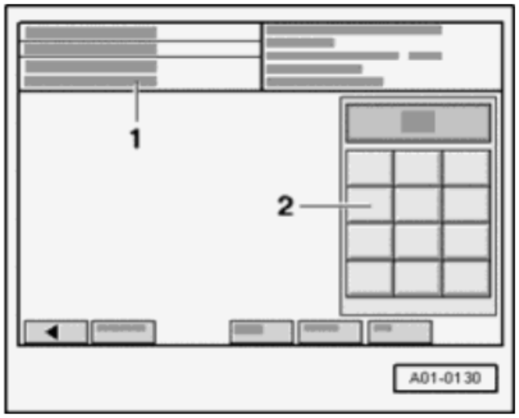

Fig. 91: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "198" for "display group number 198" in zone -2- and confirm entry by pressing -Q- button.

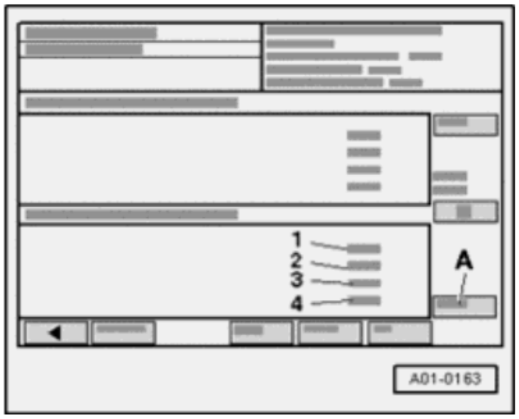

Fig. 92: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Press accelerator and brake pedal simultaneously. Engine speed increases to approx. 2200 RPM.

Test conditions

- Accelerator and brake pedal pressed simultaneously, engine runs at approx. 2200 RPM.

- Check indication in display fields -2- and -4-.

	Display zones			
	1	2	3	4
Display group 198: Diagnosis of catalytic converter (Bank 1 and Bank 2)				
Display	x.xx	---	x.xx	---
Display	Measured value catalytic converter - conversion, Bank 1	**Diagnosis status**	Measured value catalytic converter - conversion, Bank 2	**Diagnosis status**
Range		**Test OFF** **Test ON** **Cat. B1 OK** **Cat. B1 NOK**		**Test OFF** **Test ON** **Cat. B2 OK** **Cat. B2 NOK**
Specif.value	0...0.35	**Cat. B1 OK**	0...0.35	**Cat. B2 OK**
Note:		If "Cat. B1 NOK" is displayed: Check DTC memory. Refer to **Diagnostic**		If "Cat. B1 NOK" is displayed: Check DTC memory. Refer to **Diagnostic**

		Trouble Code (DTC) memory, checking . If no DTC is stored, replace catalytic converter.		**Trouble Code (DTC) memory, checking** . If no DTC is stored, replace catalytic converter.

If specified value "Cat. B1 OK" is obtained:

- Press <-- button.
- Depress accelerator pedal completely (swiftly) and then release it (brief acceleration to at least 4000 RPM).

WARNING: Test procedure cannot continue successfully without this brief acceleration!

- Perform next operation.

Operation 12: Diagnosis of secondary air injection system

Test conditions

- Engine running at idling speed

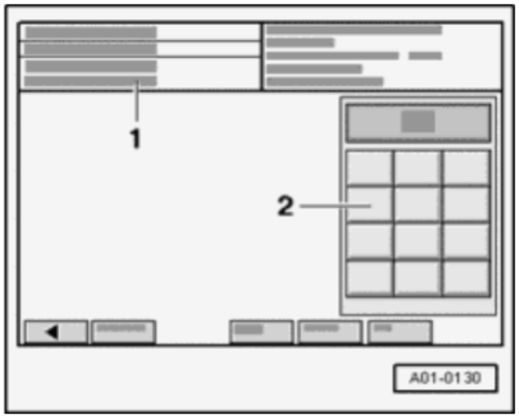

Fig. 93: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "199" for "display group number 199" in zone -2- and confirm entry by pressing -Q- button.
- Depress gas pedal completely (swiftly) two times and then release it (brief acceleration of at least 4000 RPM).

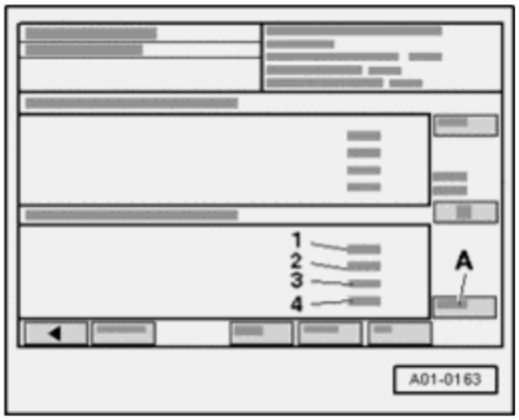

Fig. 94: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.

NOTE: **During the diagnosis of the secondary air system the secondary air pump runs several seconds.**

- Check indication in display field -4-.

	Display zones			
	1	2	3	4
Display group 199: Diagnosis of secondary air injection system (Bank 1 and Bank 2)				
Display	xxxx RPM	xx%	%	**---**
Display	Engine speed	Relative air mass Bank 1, secondary air system	Relative air mass Bank 2, secondary air system	**Diagnosis status**
Range				**Test OFF** **Test ON** **Syst. OK** **Syst. NOK** **Cancel**
Specif. value	700 to 800 RPM			Syst. OK
Note:				If "Syst. NOK" is displayed: Check DTC memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking**

If specification "Syst. OK" is obtained:

- Press <-- button.
- Perform next operation.

Operation 13: Reading readiness code

- Read readiness code. Refer to **Reading readiness code**.

, Component locations. , Removal and Installation procedures.

GENERIC SCAN TOOL

OBD GENERAL INFORMATION

OBD General Information

The following table provides quick links to all chapters in this section.

--> **Generic Scan Tool Manual Contents**.
--> **OBD Systems**.
--> **Malfunction Indicator Lamp Illumination**.
--> **CAN Data Link**.
--> **Electronic Power Control Warning Lamp**.

--> **Generic Scan Tool Manual Contents**

--> **OBD Systems**

--> **Malfunction Indicator Lamp Illumination**

--> **CAN Data Link**

--> **Electronic Power Control Warning Lamp**

Generic Scan Tool Manual Contents

GST is an acronym for Generic Scan Tool Manual.

Included in the contents of this GST manual is a summary table of the vehicle specific OBD II Emission Related Engine and Transmission DTCs. This table contains all necessary Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination to accurately monitor and diagnose the Engine Emissions and Transmission and perform all functions required to run Modes 01 through 09 with a hand held scan tool. For a further description of the monitor strategies, a document reference has been provided throughout this GST manual to the applicable OBD System Strategy document.

This GST manual also contains the step by step pin point test procedures to accurately diagnose the suspected component or system once a DTC has been set. All references to repair procedures and wiring diagrams will be found within the diagnostic test procedure.

OBD Systems

OBD II

OBD is an acronym for the On Board Diagnostic System.

California OBD II applies to all gasoline engine vehicles up to 14,000 lbs. Gross Vehicle Weight Rating (GVWR) starting in the 1996 MY and all diesel engine vehicles up to 14,000 lbs. GVWR starting in the 1997 MY.

Several states in the Northeastern United States have chosen to adopt the California emission regulations starting in the 1998 MY and are known as "Green States".

Green States receive California-certified vehicles for passenger cars and light trucks up to 6,000 lbs. GVWR. Starting in the 2004 MY, Federal vehicle over 8,500 lbs. will start phasing in OBD II.

Starting in 2004 MY, gasoline-fueled Medium Duty Passenger Vehicles (MDPVs) are required to have OBD II. Federal OBD II applies to all gasoline engine vehicles up to 8,500 lbs. GVWR starting in the 1996 MY and all diesel engine vehicles up to 8,500 lbs. GVWR starting in the 1997 MY.

OBD II system implementation and operation is described in the remainder of this document.

Malfunction Indicator Lamp Illumination

MIL is an acronym for the Malfunction Indicator Lamp.

If the ECM recognizes a malfunction that leads to increased emissions values, it indicates them by lighting the MIL which is located in the instrument cluster.

The ECM switches on the MIL after the ignition is switched on. Shortly after the engine is started, The MIL goes out if the ECM does not detect a malfunction that increases the emissions values.

If the ECM recognizes a malfunction that leads to increased emissions during the operation of the engine, the ECM switches on the MIL and an entry is stored in the DTC memory of the ECM.

CAN Data Link

CAN is an acronym for Controller Area Network.

The ECM communicates with all databus capable control modules by a CAN Data Link.

The databus capable control modules (i.e. Engine Coolant temperature Sensor) are connected by two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages) to the ECM. Missing information on the databus is then recognized and stored as a malfunction.

The ECM illuminates the MIL through the CAN data link and tells the MIL to turn on, turn off, or blink.

Electronic Power Control Warning Lamp

EPC is an acronym that stands for the Electronic Power Control (E-gas).

The ECM monitors all EPC components after the ignition is switched on.

If a malfunction is recognized in the EPC system during the operation of the engine, the ECM switches on the EPC which is located in the instrument cluster and an entry is stored in the DTC memory of the ECM.

DIAGNOSTIC MODE, SELECTING

Diagnostic Mode, Selecting

--> **Diagnostic Modes Description**

--> **Diagnostic Mode 01 - Obtain Data**

--> **Diagnostic Mode 02 - Obtain Operating Conditions**

--> **Diagnostic Mode 03 - Interrogating Fault Memory**

--> **Interrogating the Fault Memory**

--> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**

--> **Diagnostic Mode 05: Check lambda test results**

--> **Diagnostic Mode 06: Checking test results of components that are not continuously monitored**

--> **Diagnostic Mode 07 - Check Test Results of Components that are Continuously Monitored**

--> **Diagnostic Mode 08 - Tank Leak Test**

--> **Diagnostic Mode 09 - Vehicle Information**

Diagnostic Modes Description

The information provided in Modes 01 through 09 displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTC trouble codes, generate readiness codes, and select the various PIDs and Test-IDs used within the modes to monitor the engine, and emission related component parameters.

The following table provides a link to all diagnostic modes that monitor all components and systems which influence the emission quality.

NOTE:

- **Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).**

Selectable diagnostic modes
--> **Diagnostic Mode 01 - Obtain Data**.
--> **Diagnostic Mode 02 - Obtain Operating Conditions**.
--> **Diagnostic Mode 03 - Interrogating Fault Memory**.
--> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
--> **Diagnostic Mode 05: Check lambda test results**.
--> **Diagnostic Mode 06: Checking test results of components that are not continuously monitored**.
--> **Diagnostic Mode 07 - Check Test Results of Components that are Continuously Monitored**.
--> **Diagnostic Mode 08 - Tank Leak Test**.
--> **Diagnostic Mode 09 - Vehicle Information**.

Diagnostic Mode 01 - Obtain Data

Diagnostic Mode 01 is used to display and monitor all emissions related measured values.

Depending on scan tool and protocol used, the information displayed in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and be referenced by only a number.

Test requirement

- Coolant temperature at least 80°C.

Procedure

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Diagnostic Mode 1: Obtain data.".
- From the following table, select the desired the "PID" that is to be monitored, e.g. "PID 05-Coolant temperature".

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
04:	Calculated load value
05:	Coolant temperature
06:	Oxygen integrator, bank 1
07:	Oxygen adaptation value, bank 1
08:	Oxygen integrator, bank 2
09:	Oxygen adaptation value, bank 2
12:	Engine RPM
13:	Vehicle speed
14:	Ignition timing adjustment at 1. cyl. in direction

15:	Intake air temperature (IAT)
16:	Air flow quantity at Mass Air Flow (MAF) sensor
17:	Throttle valve position (absolute)
18:	Secondary air injection (AIR)
19:	Oxygen sensor location
21:	Sensor voltage Bank 1 Sensor 2
25:	Sensor voltage Bank 2 Sensor 2
28:	OBD request is designed for diagnostic of this vehicle
33:	Driven distance after MIL on
52:	Oxygen sensor value Bank 1 Sensor 1
56:	Oxygen sensor value Bank 2- sensor 1

- Switch the ignition off.

End of procedure

Diagnostic Mode 02 - Obtain Operating Conditions

Diagnostic Mode 02 is used to monitor the operating conditions under which the Engine Control Module (ECM) has detected and stored an emissions related DTC.

NOTE:

- **Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).**

Procedure

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Diagnostic Mode 2: Obtain operating conditions".
- From the following table, select the desired the "PID" , e.g. "PID 05-Coolant temperature" that is to be monitored.

NOTE:

- **More than one "PID" may be selected and monitored.**

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
04:	Calculated load value
05:	Coolant temperature

06:	Oxygen integrator, bank 1
07:	Oxygen adaptation value, bank 1
08:	Oxygen integrator, bank 2
09:	Oxygen adaptation value, bank 2
12:	Engine RPM
13:	Vehicle speed

- Switch the ignition off.

End of procedure

Diagnostic Mode 03 - Interrogating Fault Memory

Description

When the Engine Control Module (ECM) recognizes an emission related fault it turns on the Malfunction Indicator Lamp (MIL) or if a Electronic Throttle Malfunction is recognized, the Engine Control Module (ECM) turns on the Electronic Power Control (EPC) Warning Lamp which are both located in the instrument cluster.

Diagnostic Mode 03 is used to retrieve and view any DTC which may be stored in the Engine Control Module (ECM).

The DTCs are sorted by SAE code with the DTC tables consisting of a 5-digit alpha-numeric value.

NOTE:

- **Depending on scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.**

The following tables provide a breakdown and explanation of the DTC code.

P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios

P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

Interrogating the Fault Memory

Procedure

- Connect the scan tool.
- Switch the ignition to the "ON" position.
- Select "Diagnostic Mode 03: Interrogating fault memory ".
- The stored DTC or DTCs will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code (DTC)
Evaporative Emission (EVAP) Canister Purge Regulator Valve	Malfunctioning wiring path or malfunctioning component
Circuit Open	Malfunction type as next

- Refer to the following DTC tables for the diagnostic repair procedure:

- --> **SAE P0xxx Diagnostic Trouble Codes**.
- --> **SAE P1xxx Diagnostic Trouble Codes**.
- --> **SAE P2xxx Diagnostic Trouble Codes**.
- --> **SAE P3xxx Diagnostic Trouble Codes**.

- --> **SAE U0xxx Diagnostic Trouble Codes**.

- Switch the ignition off.

End of procedure

Diagnostic Mode 04 - Reset/Delete Diagnostic Data

Diagnostic Mode 04 is used to reset or delete the following stored information:

- All emission related malfunctions in the DTC memory.
- The operating conditions at which a malfunction was stored will be reset.
- All adaptation values.
- The test results of all diagnostic functions.

NOTE:

- **Depending on scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.**

Procedure

- Connect the scan tool.
- Switch the ignition to the "ON" position.
- Select "Diagnostic Mode 03: Interrogating fault memory ".
- Then select "Mode 4: Reset/delete diagnostic data".

The scan tool will display: "Diagnostic data are being erased".

- Switch the ignition off.

End of procedure

Diagnostic Mode 05: Check lambda test results

The individual tests in Diagnostic Mode 05 display the results of emission related components and systems which are not continuously monitored.

The min max values for each individual test in Mode 05 represent the min max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool companys development process. e.g.:

	Minimum Value
GST Manual documentation	0.3499
Aftermarket Scan Tool display	0.35

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test-ID (Hex-ID)	Component or System
01 ($01): **Oxygen Sensor in front of Catalytic Converter Bank 1 - Sensor 1**	Oxygen Sensor in front of Catalytic Converter Bank 1 - Sensor 1
01 ($01): **Oxygen Sensor in front of Catalytic Converter Bank 2 - Sensor 1**	Oxygen Sensor in front of Catalytic Converter Bank 2 - Sensor 1
01 ($01): **Oxygen Sensor Behind Catalytic Converter Bank 1 Sensor 2**	Oxygen Sensor Behind Catalytic Converter Bank 1-Sensor 2
01 ($01): **Oxygen Sensor Behind Catalytic Converter Bank 2- Sensor 2**	Oxygen Sensor Behind Catalytic Converter Bank 2-Sensor 2

Oxygen Sensor in front of Catalytic Converter Bank 1 - Sensor 1

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 05 - Check Lambda Test Results".

Select Test ID 01 ($01).

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01($01)		Voltage threshold from rich to lean (fixed value).	0.9212	1.0781	---
02($02)		Voltage threshold from lean to rich (fixed value).	0.9212	1.0781	---
07($07)	P0133	Minimum oxygen sensor voltage value in test.	0.9961	4.0039	Refer to DTC P0133 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values .
08($08)		Maximum	-0.0309	0.0309	---

		oxygen sensor voltage value in test.			
09($09)	P0133	Half cycle duration of oxygen sensor signal in test.	40 ms	0.520 seconds	---
48	---	Adjustment to rich via oxygen sensor control behind catalytic converter Bank 1.	0 Sec	0.8 Sec	---
49	---	Adjustment to lean via oxygen sensor control behind catalytic converter Bank 1.	0 Sec	0.8 Sec	---
50	---	Period duration of oxygen sensor signal in front of catalytic converter in test.	200 mS	1 Sec	

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis.

Oxygen Sensor in front of Catalytic Converter Bank 2 - Sensor 1

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 05 - Check Lambda Test Results".

Select Test ID 01 ($01)

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)		Voltage	---	---	---

		threshold from rich to lean (fixed value).			
02 ($02)		Voltage threshold from lean to rich (fixed value).	---	---	---
07 ($07)		Minimum oxygen sensor voltage value in test.	0 mV	401.6 mV	---
08($08)		Maximum oxygen sensor voltage value in test.	500.7 mV	1048.4 mV	---
09($09)	P0153	Half cycle duration of oxygen sensor signal in test.	40mS	0.52 Sec	Refer to DTC P0153 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
48	---	Adjustment to rich via oxygen sensor control behind catalytic converter Bank 1.	0 Sec	0.8 Sec	---
49	---	Adjustment to lean via oxygen sensor control behind catalytic converter Bank 1.	0 Sec	0.8 Sec	---
50	---	Period duration of oxygen sensor signal in front of catalytic converter in test.	200 mS	1 Sec	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.

- Switch the ignition off.

End of diagnosis.

Oxygen Sensor Behind Catalytic Converter Bank 1 Sensor 2

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 05 - Check Lambda Test Results".

Select "Test-ID 01($01".

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	---	Voltage threshold from rich to lean (fixed value).	600 mV	---	---
02 ($02)	---	Voltage threshold from lean to rich (fixed value).	600 mV	---	---
07 ($07)	---	Minimum oxygen sensor voltage value in test.	0 mV	600 mV	---
08 ($08)	P0138	Short to Battery Check.	600 mV	1048 mV	Refer to DTC P0138 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis.

Oxygen Sensor Behind Catalytic Converter Bank 2- Sensor 2

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 05 - Check Lambda Test Results".

Select "01 ($01)".

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	---	Voltage threshold from rich to lean (fixed value).	600 mV	---	---
02 ($02)	---	Voltage threshold from lean to rich (fixed value).	600 mV	---	---
07 ($07)	---	Minimum oxygen sensor voltage value in test.	0 mV	600 mV	---
08($08)	P0158	Short to Battery Check.	600 mV	1048 mV	Refer to DTC P0158 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis.

Diagnostic Mode 06: Checking test results of components that are not continuously monitored

The individual tests in Diagnostic Mode 06 display the results of emission related components and systems which are not continuously monitored.

The min max values for each individual test in Mode 06 represent the min max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool companys development process. e.g.:

	Minimum Value
GST Manual documentation	0.3499
Aftermarket Scan Tool display	0.35

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

NOTE:

- **Depending on the scan tool and protocol used, the information displayed in diagnostic mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).**

Test requirements

- Exhaust system must be properly sealed between catalytic converter and cylinder head.
- No DTCs in the DTC memory.
- Coolant temperature at least 80°C.

Work procedure

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select the desired "Test-ID"..

The current minimum and maximum values will be displayed on the scan tool screen.

Test-ID (Hex-ID)	Component or System
01 ($01): **Test-ID 01 ($01): Catalytic Conversion (Bank 1)**	Catalytic Conversion (Bank 1)
01 ($01): **Test-ID 01 ($01): Catalytic Conversion (Bank 2)**	Catalytic Conversion (Bank 2)
01 ($01): **Test-ID 01 ($01): Oxygen Sensor (Bank 1, Sensor 1)**	Oxygen Sensor (Bank 1, Sensor 1)
02 ($02): **Test-ID 02 ($02): Oxygen Sensor (Bank 2, Sensor 1)**	Oxygen Sensor (Bank 2, Sensor 1)

15 ($21): **Test-ID 15 ($21): Oxygen Sensor (Bank 1, Sensor 2)**	Oxygen Sensor (Bank 1, Sensor 2)
16 ($22): **Test-ID 16 ($22): Oxygen Sensor (Bank 2, Sensor 2)**	Oxygen Sensor (Bank 2, Sensor 2)
03 ($03): **Test-ID $03 (03): Secondary Air Injection (AIR) System (Bank 1)**	Secondary Air Injection (AIR) System (Bank 1)
03 ($03): **Test-ID $03 (03): Secondary Air Injection (AIR) System (Bank 2).**	Secondary Air Injection (AIR) System (Bank 2)
05 ($05): **Test-ID $05 (05): Tank Ventilation System, Tank Vent Valve Function Check.**	Tank Ventilation System, Tank Vent Valve Function Check
05 ($05): **Test-ID $05 (05): Tank Ventilation System, Tank Leak Test.**	Tank Ventilation System, Tank Leak Test

Test-ID 01 ($01): Catalytic Conversion (Bank 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 01 ($01)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
05 ($05)	P0421	Catalytic converter monitoring bank 1, aging value.	---	0.025	Refer to DTC P0421 in the DTC table --> **SAE P0xxx Diagnostic Trouble Codes**.
07 ($07)	P0421	Catalytic converter monitoring sum malfunction bank 1 + bank 2, aging value.	---	1.1016	Refer to DTC P0421 in the DTC table --> **SAE P0xxx Diagnostic Trouble Codes**.
08 ($08)	P0421	Catalytic converter monitoring sum range malfunction bank 1, aging value.	---	0.9961	Refer to DTC P0421 in the DTC table --> **SAE P0xxx Diagnostic Trouble Codes**.

10 ($0A)	---	Catalytic converter monitoring bank 1, aging value short test.	---	0.3984	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID 01 ($01): Catalytic Conversion (Bank 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".
- Select the desired "Test-ID".

Select "Test-ID 01 ($01)".

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
06 ($06)	P0431	Conversion Capability (storage) Check.	---	0.025	Refer to DTC P0431 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
07 ($07)	P0421	Catalytic converter monitoring sum malfunction bank 1 + bank 2, aging value.	---	1.1016	Refer to DTC P0431 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring

					values.
09 ($09)	P0431	Conversion Capability (storage) Check.	---	0.9961	Refer to DTC P0431 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
11 ($0B)	---		---	0.3984	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID 01 ($01): Oxygen Sensor (Bank 1, Sensor 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 01 ($01)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01($01)	P0133	Period duration bank 1.	100 mS	1 Sec	Refer to DTC P0133 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
03($03)	---	TV adaptation bank 1.	800 mS	800 mS	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID 02 ($02): Oxygen Sensor (Bank 2, Sensor 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 02 ($02)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
02($02)	P0153	Period duration bank 2.	100 mS	1 Sec	Refer to DTC P0153 in the OBD DTC Summary Table --> **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
04($04)	---	TV adaptation bank 2.	800 mS	800 mS	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID 15 ($21): Oxygen Sensor (Bank 1, Sensor 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 15 ($21)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
15 ($21)	---	Oxygen sensor voltage rich behind catalytic converter bank 1.	---	---	---
17($23)	---	Oxygen sensor voltage lean behind catalytic converter bank 1.	---	---	---
19($25)	---	Oxygen sensor voltage in deceleration behind catalytic converter bank 1.		103 mV	
1B($27)	---	Dynamic behind catalytic converter bank 1.	5.2 mV/ms		

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID 16 ($22): Oxygen Sensor (Bank 2, Sensor 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 16 ($22)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
16($22)	---	Oxygen sensor voltage rich behind catalytic converter bank 2.	---	---	---
18($24)	---	Oxygen sensor voltage lean behind catalytic converter bank 2.	---	---	---
1A($26)	---	Oxygen sensor voltage in deceleration behind catalytic converter bank 2.	---	103 mV	---
1C($28)	---	Dynamic behind catalytic converter bank 2.	5.2 mV/mS	---	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID $03 (03): Secondary Air Injection (AIR) System (Bank 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 03 ($03)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	P0491	Reduced secondary air	0.2969	---	Refer to DTC P0491 in the

		mass bank 1.			OBD DTC Summary Table for all monitoring values. --> **SAE P0xxx Diagnostic Trouble Codes**.
02 ($02)	P0491	Very low secondary air mass bank 1, also short test.	0.0156	---	Refer to DTC P0491 in the OBD DTC Summary Table for all monitoring values. --> **SAE P0xxx Diagnostic Trouble Codes**.
03 ($03)	P0491	Leakage bank 1 (combi-valve does not close), short test.	---	1.2kg/k	Refer to DTC P0491 in the OBD DTC Summary Table for all monitoring values. --> **SAE P0xxx Diagnostic Trouble Codes**.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID $03 (03): Secondary Air Injection (AIR) System (Bank 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 03 ($03)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
04 ($04)	P0492	Reduced secondary air mass bank 2.	0.5	---	Refer to DTC P0492 in the DTC table --> **SAE P0xxx Diagnostic Trouble Codes**.
05($05)	---	Leakage bank 2 (combination valve does not close), short test.	---	4 kg/k	Refer to DTC P0492 in the DTC table --> **SAE P0xxx Diagnostic Trouble Codes**.
06 ($06)	P0492	Very low secondary air mass bank 2, also short test.	0.4	---	

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID $05 (05): Tank Ventilation System, Tank Vent Valve Function Check

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 05 ($05)".

- Select the desired "Test-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	---	Tank ventilation valve check of DLDP during initial flush.	--	---	---
02 ($02)	---	Reduction of drop-out time	---	---	---

		when flushing.			
03 ($03)	---	Passive test (can only test if OK).	0.1484	---	---
04 ($04)	---	Active test: deviation of oxygen sensor regulator in lean direction (can only be checked if OK), also short test.	0.05	---	---
05 ($05)	---	Active test: deviation of oxygen sensor regulator in rich direction (can only be checked if OK), also short test.	-0.05	---	---
06 ($06)	---	Active test: air balance at idle OK, also short test.	40%	---	---
07 ($07)	P0441	Fuel Tank Leak Test.	40%	---	Refer to DTC P0441 in the DTC table --> **SAE P0xxx Diagnostic Trouble Codes**.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

Test-ID $05 (05): Tank Ventilation System, Tank Leak Test

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Check Test Results of Components that are not Continuously Monitored".

Select "Test-ID 05 ($05)".

- Select the desired "Test-ID".

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
13 ($0D)	P0455	Large/small leak.	---	---	Refer to DTC P0455 in the OBD DTC Summary Table for all monitoring values --> **SAE P0xxx Diagnostic Trouble Codes**.
13 ($0D)	P0442	Large/small leak.	---	---	Refer to DTC P0442 in the OBD DTC Summary Table for all monitoring values. --> **SAE P0xxx Diagnostic Trouble Codes**.
14 ($0E)	P2403	Reed contact not closed.	---	1 Sec	Refer to DTC P2403 in **SAE P2xxx Diagnostic Trouble Codes** .
15 ($0F)	P2404	Reed contact does not open.	---	20	Refer to DTC P2404 in **SAE P2xxx Diagnostic Trouble Codes**. .
16 ($10)	---	System not OK during initial flush.	20 Sec + 15 Sec	---	Refer to DTC P0456 in the OBD DTC Summary Table for all monitoring values.
17 ($11)	---	Pinhole leak.	---	---	---

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.

- Switch the ignition off.

End of diagnosis

Diagnostic Mode 07 - Check Test Results of Components that are Continuously Monitored

Diagnostic Mode 07 displays all stored DTCs of emission related components and systems which are continuously monitored.

NOTE:

- **Depending on scan tool and protocol used, diagnostic mode 07 and the information provided may be referred to by a different name.**

Procedure

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Diagnostic Mode 07 - Check Test Results of Components that are Continuously Monitored".

The number of stored DTCs or "0 malfunctions detected" will be displayed scan tool screen.

- Switch the ignition off.
- Refer to the following DTC tables for the diagnostic repair procedure:

- --> **SAE P0xxx Diagnostic Trouble Codes**.
- --> **SAE P1xxx Diagnostic Trouble Codes**.
- --> **SAE P2xxx Diagnostic Trouble Codes**.
- --> **SAE P3xxx Diagnostic Trouble Codes**.

- --> **SAE U0xxx Diagnostic Trouble Codes**.

- Switch the ignition off.

End of procedure

Diagnostic Mode 08 - Tank Leak Test

Diagnostic Mode 08 is used to determine if the fuel system may be leaking.

Depending on the scan tool being used, the function test in Diagnostic Mode 08 may or may not be able to be performed.

If the scan tool being used will operate Diagnostic Mode 08, perform the test below **Function test**.

If the scan tool being used will not operate Diagnostic Mode 08, refer to --> **EVAP System, Detecting Leaks**.

NOTE:

- **Always follow the manufacturers instructions for the scan tool being used.**

Test requirements

- No DTCs stored in the DTC memory.
- Intake Air Temperature (IAT) maximum 60°C.
- Coolant temperature 80 -110°C.
- Throttle valve angle 12.0 - 16.0%.

Function test

NOTE:

- **If the accelerator pedal is depressed during the test, the test will be aborted.**

- Connect the scan tool.
- Start the engine and run at idle for at least 15 minutes.
- Select "Diagnostic Mode 08 - Tank Leak Test".
- Select " Tank Leak Test".

- Check the specified value of the tank leak test at idle.
- The following may be displayed on the scan tool screen:

Tank leak test	Specified value
• Test function active • Test function is being initiated, please wait • Test off • Test aborted	Test OK

- Switch the ignition off.

If the specified result is obtained:

System OK.

If the specified result is not obtained:

- Repeat the tank leak test, switch the ignition off and start the engine again and let run for 15 minutes at idle.

- Switch the ignition off.

If the specified result is again not obtained:

- A leak may be present. Refer to --> **EVAP System, Detecting Leaks**.

End of diagnosis.

Diagnostic Mode 09 - Vehicle Information

NOTE:

- **For all calibration and immobilizer information.**

Diagnostic Mode 09 is used to display vehicle specific information, e.g. the different Engine Control Module (ECM) versions.

NOTE:

- **Depending on scan tool and protocol used, diagnostic mode 09 and the information provided may be referred to by a different name.**

Test requirement

- No DTCs stored in the DTC memory.

Procedure

- Connect the scan tool.
- Switch the ignition on.
- Select "Diagnostic Mode 09 - Vehicle Information".
- Select the desired "Test-ID".

- The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all "Test-IDs" that may be selected.

Test-ID	**Diagnostic text**
02:	Vehicle identification number e.g.
	• A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	• Engine Control Module (ECM)
	• Transmission Control Module (TCM)
06:	CVN (check sum) e.g.
	• EC5AE460 the check sum is different for

	every control module version
	- 000D105

- Switch the ignition off.

End of procedure

GENERAL DIAGNOSIS

General Diagnosis

--> **Preliminary Check**

Preliminary Check

Before performing any pin point test or component diagnosis, a preliminary check must be performed.

Check the Technical Bulletins for information that may supersede any information included in this article.

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, check for any stored or related DTCs.

If other DTCs are stored:

- Repair these DTCs first before performing the following procedure.

If no other DTCs are stored:

- Using the scan tool, erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to attempt to duplicate the customers complaint.

If the DTC returns:

- Perform the diagnostic procedure.

If the DTC does not return:

- The fault is intermittent or a sporadic condition may exist.
- Check the suspected component, electrical harness and electrical harness connectors for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.
- Perform a road test to verify the repair.

If the DTC returns:

- Perform the diagnostic procedure.

If the DTC does not return:

The fault may have been the result of a loose electrical connection.

- Generate readiness code. Refer to --> **Readiness Code Description**.

End of diagnosis

READINESS CODE

Readiness Code

--> **Readiness Code Description**

Readiness Code Description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturers instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General Recommendations

Most monitors will complete easier and quicker using a steady-foot and smooth acceleration during the drive cycle operation, cruise, and acceleration modes.

Operating Conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10°C and 35°C with a difference between them no greater than 4°C. The ambient air temperature must not change more than 4°C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).

Test requirements

- Erase the DTC memory.

- Coolant temperature must be between 80°C and 110°C.
- The Intake Air Temperature (IAT) must be between 10°C and 35°C.
- Battery voltage must be a minimum of 12.5 volts.

- Fuel tank level 1/4 to 3/4 full.

CAUTION: When performing the drive cycle operation, pay strict attention to driving conditions and please observe and obey all posted speed limits. Failure to follow these instructions may result in personal injury or possible death.

Drive Cycle Procedure

- Connect the scan tool.
- Switch the ignition on and start the vehicle.
- Idle the vehicle for 2-3 minutes. This executes the O2S Heater, Misfire, Secondary AIR, Fuel Trim, and Purge system monitors.
- Drive the vehicle at 45-55 mph for a continuous 7-minute period, avoid stopping. This executes the EVAP, O2S, Fuel Trim, and Misfire monitors.

- Accelerate the vehicle to an engine speed of 5,000 RPM (with automatic transmission use the tip-tronic mode); lift off the throttle until the engine speed is around 1,200 RPM. This executes the fuel cut off
- Accelerate the vehicle smoothly to 60-65 mph, cruise constantly for 5 min, this executes the Catalyst; O2S, Misfire, Fuel Trim, and Purge System monitors.
- Decelerate and idle the vehicle again for 3 minutes. This executes the Misfire, Secondary AIR, Fuel Trim, and Purge system monitors.
- Check the status of the readiness code.

NOTE:

- **Depending on the scan tool used. The readiness code status may be displayed as complete, passed or OK.**

- If any engine monitor fails the drive cycle test: Repeat the drive cycle test until all engine monitors have successfully run through and passed.

NOTE:

- **When repeating the drive cycle operation for a failed EVAP monitor or thermostat-monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are be between 10°C and 35°C with a difference between them no greater than 4°C is observed and repeat the drive cycle operation.**

If the drive cycle operation fails again.

- Check the DTC memory for stored DTCs.

Repair the vehicle if necessary.

- Repeat the drive cycle operation until all engine monitors have successfully run through and passed.
- Remove the scan tool and switch the ignition off.

End of diagnosis

DIAGNOSTIC TROUBLE CODE TABLES

Diagnostic Trouble Code Tables

--> **SAE P0xxx Diagnostic Trouble Codes**

--> **SAE P1xxx Diagnostic Trouble Codes**

--> **SAE P2xxx Diagnostic Trouble Codes**

--> **SAE P3xxx Diagnostic Trouble Codes**

--> **SAE U0xxx Diagnostic Trouble Codes**

SAE P0xxx Diagnostic Trouble Codes

Fuel and air mixture, additional emissions regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0010	Intake (A) Camshaft Position Actuator Circuit/Open (Bank 1)	Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	ECT - > 5.25°C Short to ground Open circuit 4.5-5.5V	Camshaft valve - on Engine speed - > 80 RPM Battery Voltage 9.0-16.05V Camshaft valve - off Engine speed - >	0.5 Sec	2 DCY

				80 RPM - Battery Voltage 9.0-16.05V		
P0011	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	- Comparison cam-retard actual to calculated for 5 times:delta > 10° crank angle for more than 8 sec.	- Engine speed 1200 RPM - Time after engine start > 2 sec. - ECT >5.5°C	40 Sec	- 2 DCY
P0012	Intake (A) Camshaft Position Timing Over-Retarded (Bank 1) AVK Only.	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	- Comparison cam-advance actual to calculated for 5 times:delta > 10°crank angle for more than 8 sec.	- Engine speed 1200 RPM - Time after engine start > 2 sec. - ECT >5.5°C	40 Sec	- 2 DCY
P0013	"B" Camshaft Position - Actuator Circuit Bank 1	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	- Short to battery + 2.2 - 8 A - Short to ground 3V - Open circuit 4.5 - 5.5 V	- Camshaft valve - on - Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V - Camshaft valve - off	0.5 Sec	- 2 DCY

				- Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V		
P0014	"B" Camshaft Position - Timing Over-Advanced or System Performance Bank 1	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	- Comparison cam-advance actual to calculated for 5 times:delta > 8° crank angle for more than 6 Sec.	- Engine speed, 1700 RPM - Time after engine start > 2 sec. - ECT >70°C	30 Sec	- 2 DCY
P0015	"B" Camshaft Position - Timing Over Retarded (Bank 1)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	- Comparison cam-retard actual to calculated for 5 times:delta > 8° crank angle for more than 6 Sec.	- Engine speed, 1700 RPM - Time after engine start > 2 sec. - ECT >70°C	- 30 Sec	- 2 DCY
P0020	Intake (A) Camshaft Position Actuator Circuit/Open (Bank 2)	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	- Short to battery + 2.2 - 8 A - Short to ground 3V - Open circuit 4.5 - 5.5 V	- Camshaft valve - on - Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V - Camshaft	- 5 Sec	- 2 DCY

				valve - off - Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V		
P0021	Intake (A) Camshaft Position Timing Over-Advanced (Bank 2)	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	- Comparison cam-retard actual to calculated for 5 times:delta > 10°crank angle for more than 8 Sec.	- Engine speed, 1200 RPM - Time after engine start > 2 sec. - ECT >5.25°C	- 40 Sec	- 2 DCY
P0022	Intake (A) Camshaft Position Timing Over-Retarded (Bank 2) - (AVK only)	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	- Comparison cam-advance actual to calculated for 5 times:delta > 10°crank angle for more than 8 Sec.	- Engine speed, 1200 RPM - Time after engine start > 2 sec. - ECT >5.25°C	- 40 Sec	- 2 DCY
P0023	"B" Camshaft Position - Actuator Circuit (Bank 2)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust)**	- Short to battery + 2.2 - 8 A - Short to ground 3V - Open circuit 4.5 - 5.5 V	- Camshaft valve - on - Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V	- 0.5 Sec	- 2 DCY

		N318 , checking.		- Camshaft valve - off - Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V		
P0024	"B" Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	- Comparison cam-advance actual to calculated for 5 times:delta > 8° crank angle for more than 6 Sec.	- Engine speed, 1700 RPM - Time after engine start > 2 sec. - ECT >70°C	- 30 Sec	- 2 DCY
P0025	"B" Camshaft Position - Timing Over-Retarded (Bank 2)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	- Comparison cam-retard actual to calculated for 5 times:delta > 8° crank angle for more than 6 Sec.	- Engine speed, 1700 RPM - Time after engine start > 2 sec. - ECT >70°C	- 30 Sec	- 2 DCY
P0030	HO2S Heater Control Circuit (Bank 1, Sensor 1)	○ Check the Oxygen Sensor (O2S) Heater Z19. Refer to **Oxygen Sensor**	- Open circuit 2.34-3.59 V	- Sensor heater off - Battery voltage 10.77 - 16.05 V	5 Sec	- 2 DCY

		(O2S) Heater Z19 , Checking.				
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	○ Check the Oxygen Sensor (O2S) Heater Z19. Refer to **Oxygen Sensor (O2S) Heater Z19 , Checking**.	Short to ground - 2.34 V	• Sensor heater off • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0032	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	○ Check the Oxygen Sensor (O2S) Heater Z19. Refer to **Oxygen Sensor (O2S) Heater Z19 , Checking**.	Short to battery + >3.59 V	• Sensor heater off • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0036	HO2S Heater Control Circuit (Bank 1, Sensor 2)	○ Check the Oxygen Sensor (O2S) Heater Z29. Refer to **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 , Checking**.	Open circuit 4.5-5.5 V	• Sensor heater off • Engine speed >80 RPM • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0037	HO2S Heater	○ Check the	Short to ground 3	• Sensor	5 Sec	• 2 DCY

	Control Circuit Low (Bank 1, Sensor 2)	Oxygen Sensor (O2S) Heater Z29. Refer to **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 , Checking**.	V	heater off • Engine speed >80 RPM • Battery voltage 10.77 - 16.05 V		
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2)	○ Check the Oxygen Sensor (O2S) Heater Z29. Refer to **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 , Checking**.	Short to battery + >2.7-5.5 A	• Sensor heater off • Engine speed >80 RPM • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0050	HO2S Heater Control Circuit Bank 2 Sensor 1	○ Check the Oxygen Sensor (O2S) 2 Heater Z28. Refer to **Oxygen Sensor (O2S) 2 Heater Z28 , Checking**.	Open circuit 2.34-3.59 V	• Sensor heater off • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0051	HO2S Heater	○ Check the	Short to ground -	• Sensor	5 Sec	• 2 DCY

	Control Circuit Low Bank 2 Sensor 1	Oxygen Sensor (O2S) 2 Heater Z28. Refer to **Oxygen Sensor (O2S) 2 Heater Z28 , Checking**.	2.34 V	heater off • Battery voltage 10.77 - 16.05 V		
P0052	HO2S Heater Control Circuit High Bank 2 Sensor 1	○ Check the Oxygen Sensor (O2S) 2 Heater Z28. Refer to **Oxygen Sensor (O2S) 2 Heater Z28 , Checking**.	Short to battery + >3.59 V	• Sensor heater off • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0056	HO2S Heater Control Circuit Bank 2 Sensor 2	○ Check the Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30. Refer to **Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 , checking**	Open circuit 4.5-5.5 V	• Sensor heater off • Engine speed >80 RPM • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY
P0057	HO2S Heater	○ Check the	Short to ground 3	• Sensor	5 Sec	• 2 DCY

	Control Circuit Low Bank 2 Sensor 2	Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30. Refer to **Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 , checking**	V	heater off • Engine speed >80 RPM • Battery voltage 10.77 - 16.05 V		
P0058	HO2S Heater Control Circuit High Bank 2 Sensor 2	○ Check the Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30. Refer to **Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 , checking**	Short to battery + >2.7-5.5 A	• Sensor heater off • Engine speed >80 RPM • Battery voltage 10.77 - 16.05 V	5 Sec	• 2 DCY

Fuel and air ratio

DTC	Error Message	Diagnostic	Malfunction	Secondary	Monitoring	Fre

		Procedure	Criteria and Threshold Value	Parameters with Enable Conditions	Time Length	chec Illur
P0101	Mass or Volume Air Flow A Circuit Range/Performance • (BGN only)	○ Check the Mass Air Flow (MAF) Sensor G70. Refer to --> **Mass Air Flow (MAF) Sensor G70 , Checking**	• Mass air flow vs. lower threshold 2-258 kg/h or • Mass air flow vs. upper Threshold map 52-901 kg/h or • Mass air flow vs. Calculated mass air flow>25% and • Fuel system (multiple) 18% or • Mass air flow vs. Calculated mass air flow25% and • Fuel system (multiple) >18%	---	320 Sec	• •
P0102	Mass or Volume Air Flow A Circuit Low Input	○ Check the Mass Air Flow (MAF) Sensor G70. Refer to --> **Mass Air Flow (MAF) Sensor G70 , Checking**	• Lower threshold map Depending on engine speed and throttle angle • Deviation between calculated and measured air	• Air mass - 2-258kg/h • Engine speed Full range • Mass air flow >30 kg/h	• 2 Sec • 320 Sec	•
P0103	Mass or Volume Air Flow Circuit High Input	○ Check the Mass Air Flow (MAF) Sensor G70. Refer to --> **Mass Air Flow (MAF) Sensor G70 ,**	Upper threshold map Depending on engine speed and throttle angle	Air mass - >52-901kg/h	2 Sec	•

		Checking				
P0106	Manifold Absolute Pressure/BARO Sensor Range/Performance	○ Check the Manifold Absolute Pressure (MAP) Sensor G71.	Difference between altitude sensor and model altitude> 275 mbar	---	3 Sec	•
P0112	Intake Air Temperature Sensor 1 Circuit Low	○ Check the Mass Air Flow (MAF) Sensor G70. Refer to --> **Mass Air Flow (MAF) Sensor G70 , Checking**	Short to ground >+141°C	---	2 Sec	•
P0113	Intake Air Temperature Sensor 1 Circuit High	○ Check the Mass Air Flow (MAF) Sensor G70. Refer to --> **Mass Air Flow (MAF) Sensor G70 , Checking**	Short to battery + - 45.75°C	---	2 Sec	•
P0116	Engine Coolant Temperature Circuit Range/Performance • (BGN only)	○ Check the Engine Coolant Temperature (ECT) Sensor G62. Refer to --> **Engine Coolant Temperature (ECT) Sensor G62 , Checking**. ○ Check the thermostat. Refer to **20 - FUEL SUPPLY SYSTEM** .	• delta ECT 3K And ECT @ start 60-74°C • ECT @ start >106°C	• Driving condition 1 One time >35 sec. • Vehicle speed 0-19 mp/h • Mass air flow >10 kg/h • and • Driving condition 2 One time >120 sec. • Vehicle speed 37-81mp/h	155 Sec • Once/DCY	• •

				• Mass air flow 112-200 kg/h		
P0117	Engine Coolant Temperature Circuit Low	○ Check the Engine Coolant Temperature (ECT) Sensor G62. Refer to --> **Engine Coolant Temperature (ECT) Sensor G62 , Checking**. ○ Check the thermostat. Refer to **20 - FUEL SUPPLY SYSTEM** .	Short to ground >141°C	---	2 Sec	•
P0118	Engine Coolant Temperature Circuit High	○ Check the Engine Coolant Temperature (ECT) Sensor G62. Refer to --> **Engine Coolant Temperature (ECT) Sensor G62 , Checking**. ○ Check the thermostat. Refer to **20 - FUEL SUPPLY SYSTEM** .	• Short to battery+ - 45.75°C • Open circuit	---	2 Sec	•
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance	○ Check the Throttle Valve Control Module J338. Refer to -->	Not plausible signal: comparison signal sensor 1 vs. signal sensor 2 and difference between signal 1 to calculated	Engine speed - >1320/min	0.5 Sec	•

		Throttle Valve Control Module J338 , Checking	throttle angle > difference between signal 2 to calculated throttle angle D > 6.3 %			
P0122	Throttle/Pedal Position Sensor A Circuit Low Input	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	Lower threshold 0.18V	---	0.14 Sec	•
P0123	Throttle/Pedal Position Sensor A Circuit High Input	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	Upper threshold >4.63 V	---	0.14 Sec	•
P0130	O2 Sensor Circuit Bank 1 Sensor 1 • (AVK only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	• Gradient of O2 sensor signal - 2 V/ms • Open circuit or no activity - Front O2-sensor sensed * = 0.99 - 1.01 • Internal voltage high (ASIC) - 3.7 - 4.8V • Internal voltage high (ASIC) - > 4.8 V	• Time after engine start > 25 sec. • Exhaust gas temp. > 300°C • Load change 4 %/segment • l-sensor - Heated up • Time after engine start	• 13 Sec • 5-25 Sec • 10 Sec • 5 Sec • 5-25 Sec	•

			- Comparison signal front vs. rear sensor Front O2-sensor sensed lean (l > 1.1) - Front O2-sensor sensed rich (l 0.9)	> 25 sec. - Air mass flow > 24 kg/h - Rear O2-signal > 0.7 V or 0.3 V - Fuel cut off False - Rear O2-signal > 0.7 V - 0.3 V	
P0131	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 1) - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	- Short to ground - Virtual mass (VM),> 2 V - Nernst voltage (UN),> 1.75V - Adjustment voltage (IA), > 0.3 V	---	2 Sec
P0132	O2 Sensor Circuit High Voltage (Bank 1, Sensor 1)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	- Short to battery - Virtual mass (VM),> 3 V - Nernst voltage (UN),> 4 V - Adjustment voltage (IA), > 1.5 V	---	2 Sec
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to	- Amplitude ratio 0.7 between sensor signal and stored value Signal low	- Engine speed 1240 - 3000 RPM - Engine load 21 - 66 %	40 Sec - Once/DCY

		Heated Oxygen Sensor (HO2S) G39 , checking.		• Load change delta 4%/segment • Fuel control - Closed loop		
P0135	O2 Heater Circuit (Bank 1, Sensor 1)	○ Check the Oxygen Sensor (O2S) Heater Z19. Refer to **Oxygen Sensor (O2S) Heater Z19 , Checking**.	• No activity after engine start ǀdeltaǀ 1 % • No activity after fuel cut off voltage 2.8 V	• Sensor heater on • Battery voltage 10.77 - 16.05 V • Mass air flow > 24 kg/h • Time after engine start -60 sec. • Sensor heater on • Battery voltage - 10.77 - 16.05 V	25 Sec • 4 Sec	
P0136	O2 Circuit (Bank 1, Sensor 2) • (BGN only)	○ Check the Oxygen Sensor (O2S) Heater Z29. Refer to **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 , Checking**.	• delta O2S rear signal, >2 V • Number of heater coupling faults >6	• Modeled exhaust gas Temp. >250°C • O2S rear - ready	50 Sec	
P0137	O2 Circuit Low Voltage (Bank 1, Sensor 2)	○ Check Oxygen Sensor (O2S)	• Short circuit 60 mV	• Short circuit 60 mV	40 Sec. At low fuel level: 600 Sec.	

		Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**		• l-Control post cat Closed loop • Catalyst temperature > 250°C • Battery voltage > 10.77 V		
P0138	O2 Sensor Circuit High Voltage (Bank 1, Sensor 2)	○ Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**	• Short to battery + signal >1.5 V	• Sensor heated up After 111 sec. full heating • Catalyst temperature > 250°C • Battery voltage >10.77V	5 Sec	
P0139	O2 Circuit Slow Response (Bank 1, Sensor 2)	○ Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way**	Sensor signal not active signal output is not oscillating at reference value 0.624 V	• Engine speed 1000 - 4000 rpm • Mass air - 15 - 120 kg/h • Rear O2 sensor readiness> 30 sec. • Rear O2 sensor	Once/DCY	

		Catalytic Converter (TWC) G130 , checking		heater and electrical check No fault • Catalyst temperature > 345°C		
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	○ Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**	• Open circuit or no activity • 400 - 500 mV	• Catalyst temp, >250°C • Sensor heated up After 111 sec. full heating • Battery voltage >10.77V	600 Sec	
P0141	O2 Heater Circuit (Bank 1, Sensor 2)	○ Check the Oxygen Sensor (O2S) Heater Z29. Refer to **Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater Z29 , Checking**.	Out of range > 0.7 27.2 kW	• Battery voltage 10.77 - 16.05 V • Catalyst temp. 200 - 600°C • Sensor heater - On	15 Sec	
P0150	O2 Sensor Circuit (Bank 2, Sensor 1) • (AVK only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer	• Gradient of O2 sensor signal - 2 V/ms • Open circuit or no activity - Front O2-	• Time after engine start > 25 sec. • Exhaust gas temp. > 300°C	• 13 Sec • 5-25 Sec • 10 Sec • 0.5 Sec	

		to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	sensorsensed * = 0.99 - 1.01 • Internal voltage high (ASIC) - 3.7 - 4.8V • Internal voltage high (ASIC) - > 4.8 V • Comparison signal front vs. rear sensor Front O2-sensor sensed lean (l > 1.1) • Front O2-sensor sensed rich (l 0.9)	• Load change 4 %/segment • l-sensor - Heated up • Time after engine start > 25 sec. • Air mass flow > 24 kg/h • Rear O2-signal > 0.7 V or 0.3 V • Fuel cut off False • Rear O2-signal > 0.7 V • 0.3 V	• 5-25 Sec	
P0152	O2 Sensor Circuit High Voltage (Bank 2, Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	Short to Battery • Virtual mass (VM),> 3 V • Nernst voltage (UN),> 4V • Adjustment voltage (IA), > 1.5 V	---	2 Sec	• •
P0153	O2 Sensor Circuit Slow Response Bank 2 Sensor 1	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2**	• Amplitude ratio 0.7 between sensor signal and stored value	• Engine speed 1240 - 3000 RPM • Engine load 21 - 66 % • Load change	40 Sec • Once/DCY	•

		G108 , checking.		delta 4%/segment - Fuel control - Closed loop		
P0155	O2 Sensor Heater Circuit Bank 2 Sensor 1	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	- No activity after engine start |delta| 1 % - No activity after fuel cut off voltage 2.8 V	- Sensor heater on - Battery voltage 10.77 - 16.05 V - Mass air flow > 24 kg/h - Time after engine start -60 sec. - Sensor heater on - Battery voltage - 10.77 - 16.05 V	25 Sec - 4 Sec	
P0156	O2 Sensor Circuit Bank 2 Sensor 2 - (BGN only)	○ Check Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131. Refer to **Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131 , checking**.	- Delta O2S rear signal, >2 V - Number of heater coupling faults >6	- Modeled exhaust gas Temp. >250°C - O2S rear - ready	50 Sec	
P0157	O2 Sensor Circuit Low Voltage Bank	○ Check Oxygen	- Short circuit 60 mV	- Sensor heated up -	40 Sec. At low fuel level: 600	

	2 Sensor 2	Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131. Refer to **Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131 , checking**.		After 111 sec. full heating • l-Control post cat Closed loop • Catalyst temperature > 250°C • Battery voltage > 10.77 V	Sec.	
P0158	O2 Sensor Circuit High Voltage Bank 2 Sensor 2	○ Check Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131. Refer to **Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131 , checking**.	• Short to battery + signal > 1.5 V	• Catalyst temp, >250°C • Sensor heated up - After 111 sec. full heating • Battery voltage > 10.77 V	5 Sec	•
P0159	O2 Sensor Circuit Slow Response Bank 2 Sensor 2	○ Check Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131. Refer to **Oxygen Sensor (O2S) 2 Behind**	Sensor signal not active. Signal output is not oscillating at reference value= 0.624 V	• Engine speed 1000...4000 rpm • Mass air - 15 - 120 kg/h • Rear O2 sensor readiness> 30 sec.	Once/DCY	•

		Three Way Catalytic Converter (TWC) G131 , checking.		- Rear O2 sensor heater and electrical check No fault - Catalyst temperature > 345°C		
P0160	O2 Sensor Circuit No Activity Detected (Bank 2, Sensor 2)	○ Check Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131. Refer to **Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) G131 , checking**.	- Open circuit or no activity - 400 - 500 mV	- Sensor heated up After 111 sec. full heating - Catalyst temperature > 250°C - Battery voltage >10.77V	600 Sec	
P0161	O2 Sensor Heater Circuit Bank 2 Sensor 2	○ Check the Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30. Refer to **Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater Z30 ,**	Out of range > 0.7 27.2 kW	- Battery voltage 10.77 - 16.05 V - Catalyst temp. 200 - 600°C - Sensor heater - On	15 Sec	

		checking				
P0170	Fuel Trim (Bank 1) • (AVK only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the Fuel Pressure Sensor G247. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way**	• System too rich > + 0.04 V • System too lean - 0.04 V	• Lambda controller Closed loop • Rear O2 sensor heater and electrical check No fault • Engine speed 1000 - 4000 RPM • Engine load 20-50% • Catalyst temperature > 345°C	200 Sec	•

		Catalytic Converter (TWC) G130 , checking. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P0171	System Too Lean (Bank 1)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors. N30, N31, N32, N33, N83, N84. Refer to --> **Fuel**	• (Additive) System too rich >-7.5% • (Multiplicative) System too rich >-20%	• Closed loop • ECT > 59.25°C (Purge valve closed) • Substitute ECT -> 69.75°C • Engine speed -1000 RPM	40 Sec	• •

		Injector , Checking. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air).		• Mass air flow -25 kg/h • Fuel adaptation Active stable • Duration of check >25 sec. • Closed loop • ECT > 60° C (Purge valve closed) • Substitute ECT -> 69.75°C • Engine speed -5600 RPM • Engine load - >21-95% • Mass air flow -30-450 kg/h • Fuel adaptation Active stable		

		○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P0172	System Too Rich (Bank 1)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84.. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 ,**	• (Additive) System too rich >-7.5% • (Multiplicative) System too rich >-20%	• Closed loop • ECT > 59.25°C (Purge valve closed) • Substitute ECT -> 69.75°C • Engine speed -1000 RPM • Mass air flow -25 kg/h • Fuel adaptation Active stable • Duration of check >25 sec. • Closed loop • ECT > 60° C (Purge valve closed) • Substitute ECT -> 69.75°C • Engine speed -5600 RPM	40 Sec	

		checking. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks		• Engine load - >21-95% • Mass air flow -30-450 kg/h • Fuel adaptation Active stable		
P0173	Fuel Trim (Bank 2) • (AVK only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the Fuel Pressure Sensor G247. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel**	• System too rich > + 0.04 V • System too lean - 0.04 V	• Lambda controller Closed loop • Rear O2 sensor heater and electrical check No fault • Engine speed 1000 - 4000 RPM • Engine load 20-50%	200 Sec	2 D

		Injector , Checking. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80,**		• Catalyst temperature > 345°C		

		Checking. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P0174	System Too Lean (Bank 2)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three	• (Additive) System too rich >-7.5% • (Multiplicative) System too rich >-20%	• Closed loop • ECT > 59.25°C (Purge valve closed) • Substitute ECT -> 69.75°C • Engine speed -1000 RPM • Mass air flow -25 kg/h • Fuel adaptation Active stable • Duration of check >25 sec. • Closed loop • ECT > 60° C(Purge valve closed)	40 Sec	

		Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. o Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. o Check the intake system for leaks (false air). o Check the exhaust system for proper seal. o Check the vacuum lines for leaks		• Substitute ECT -> 69.75°C • Engine speed -5600 RPM • Engine load - >21-95% • Mass air flow -30-450 kg/h • Fuel adaptation Active stable		
P0175	System Too Rich (Bank 2)	o Check the fuel pressure. Refer to --> **Fuel**	• (Additive) System too rich >-7.5% • (Multiplicative)	• Closed loop • ECT > 59.25°C (Purge	40 Sec	• •

		Delivery, Checking. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. ○ Check the Evaporative Emission (EVAP)	System too rich >-20%	valve closed) • Substitute ECT -> 69.75°C • Engine speed -1000 RPM • Mass air flow -25 kg/h • Fuel adaptation Active stable • Duration of check >25 sec. • Closed loop • ECT > 60° C(Purge valve closed) • Substitute ECT -> 69.75°C • Engine speed -5600 RPM • Engine load - >21-95% • Mass air flow -30-450 kg/h • Fuel adaptation Active stable	

		Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P0201	Injector Circuit Open - Cylinder 1	○ Check the fuel injector N30. Refer to --> **Fuel Injector , Checking**.	• Open circuit 4.5 - 5.5 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0202	Injector Circuit Open - Cylinder 2	○ Check the fuel injector N31. Refer to --> **Fuel Injector , Checking**..	• Open circuit 4.5 - 5.5 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0203	Injector Circuit Open - Cylinder 3	○ Check the fuel injector N32. Refer to --> **Fuel Injector , Checking**.	• Open circuit 4.5 - 5.5 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0204	Injector Circuit Open - Cylinder 4	○ Check the fuel injector N33. Refer to	• Open circuit 4.5 - 5.5 V • Signal low	• Battery voltage 9.0-16.05 V	0.5 Sec	•

		--> **Fuel Injector , Checking**.	while injection valves switched off	• Engine speed > 80 RPM		
P0205	Injector Circuit Open Cylinder 5	○ Check the fuel injector N83. Refer to --> **Fuel Injector , Checking**.	• Open circuit 4.5 - 5.5 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	
P0206	Injector Circuit Open Cylinder 6	○ Check the fuel injector N84. Refer to --> **Fuel Injector , Checking**.	• Open circuit 4.5 - 5.5 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	
P0221	Throttle Pedal Position Sensor/Switch B Circuit Range/Performance	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	• TPS 2-TPS 1>6.3% And • Actual TPS 2-calc. Value, Actual TPS 1 calc. value or • TPS 2 calc. value >6.3%	Engine speed - >1320 RPM	0.5 Sec	
P0222	Throttle Pedal Position Sensor/Switch B Circuit Low Input	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	Signal voltage, 0.16 V	---	0.14 Sec	
P0223	Throttle Pedal Position Sensor/Switch B Circuit High Input	○ Check the Throttle Valve Control Module J338.	Signal voltage, >4.88 V	---	0.14 Sec	

		Refer to --> **Throttle Valve Control Module J338 , Checking**				
P0230	Fuel Pump Primary Circuit • (AVK only)	○ Check the Transfer Fuel Pump (FP) G6. Refer to --> **Transfer Fuel Pump (FP) G6 Electrical, Checking**.	• Open circuit 4.5 - 5.5 V • Short to ground 3.0 V • Short to battery + 0.6 - 1.2 A	• Engine speed - >80 RPM • Battery voltage 9.0-16.05 V	0.5 Sec	•
P0261	Cylinder 1 Injector Circuit Low	○ Check the fuel injector N30. Refer to --> **Fuel Injector , Checking**.	• Short to ground 3 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0262	Cylinder 1 Injector Circuit High	○ Check the fuel injector N30. Refer to --> **Fuel Injector , Checking**.	• Short to battery+ 2.2-4 A • Signal high while injection valves switched on	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0264	Cylinder 2 Injector Circuit Low	○ Check the fuel injector N31. Refer to --> **Fuel Injector , Checking**..	• Short to ground 3 V • Signal low while injection valves switched off	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0265	Cylinder 2 Injector Circuit High	○ Check the fuel injector N31. Refer to --> **Fuel Injector , Checking**..	• Short to battery+ 2.2-4A • Signal high while injection valves switched on	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•
P0267	Cylinder 3 Injector Circuit Low	○ Check the fuel injector	• Short to ground 3 V	• Battery voltage 9.0-	0.5 Sec	•

		N32. Refer to --> **Fuel Injector , Checking**.	Signal low while injection valves switched off	16.05 V Engine speed > 80 RPM		
P0268	Cylinder 3 Injector Circuit High	○ Check the fuel injector N32. Refer to --> **Fuel Injector , Checking**.	Short to battery+ 2.2-4A Signal high while injection valves switched on	Battery voltage 9.0-16.05 V Engine speed > 80 RPM	0.5 Sec	
P0270	Cylinder 4 Injector Circuit Low	○ Check the fuel injector N33. Refer to --> **Fuel Injector , Checking**.	Short to ground 3 V Signal low while injection valves switched off	Battery voltage 9.0-16.05 V Engine speed > 80 RPM	0.5 Sec	
P0271	Cylinder 4 Injector Circuit High	○ Check the fuel injector N33. Refer to --> **Fuel Injector , Checking**.	Short to battery+ 2.2-4A Signal high while injection valves switched on	Battery voltage 9.0-16.05 V Engine speed > 80 RPM	0.5 Sec	
P0273	Cylinder 5 Injector Circuit Low	○ Check the fuel injector N83. Refer to --> **Fuel Injector , Checking**.	Short to ground 3 V Signal low while injection valves switched off	Battery voltage 9.0-16.05 V Engine speed > 80 RPM	0.5 Sec	
P0274	Cylinder 5 Injector Circuit High	○ Check the fuel injector N83. Refer to --> **Fuel Injector , Checking**.	Short to battery+ 2.2-4A Signal high while injection valves switched on	Battery voltage 9.0-16.05 V Engine speed > 80 RPM	0.5 Sec	
P0276	Cylinder 6 Injector Circuit Low	○ Check the fuel injector N84. Refer to --> **Fuel Injector , Checking**.	Short to ground 3 V Signal low while injection valves switched off	Battery voltage 9.0-16.05 V Engine speed > 80 RPM	0.5 Sec	

P0277	Cylinder 6 Injector Circuit High	○ Check the fuel injector N84. Refer to --> **Fuel Injector , Checking**.	• Short to battery+ 2.2-4A • Signal high while injection valves switched on	• Battery voltage 9.0-16.05 V • Engine speed > 80 RPM	0.5 Sec	•

Ignition system

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0300	Random Misfire Detected	○ Check the fuel injectors. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with Power Output Stage. Refer to --> **Ignition Coils with Power Output Stage , Checking**. ○ Check the Spark plugs. Refer to --> **Test Data, Spark Plugs** • Check the intake	• Multiple misfire first 1000 revs • 1 time threshold • Subsequent intervals 4 times threshold	• Load changes within 2 revolutions 148 - 431%/s • Time from engine start idle - 150 rpm + 1 camshaft revolution • Engine load 0% max load • Engine speed range Idle 150 RPM-6700 RPM • Engine torque > 0 Nm • Speed change 3020-4200	---	• 2 DCY

		system for leaks. • Check fuel pressure				
P0301	Cylinder 1 Misfire Detected	○ Check the fuel injector N30. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with Power Output Stage. Refer to --> **Ignition Coils with Power Output Stage , Checking**. ○ Check the Spark plugs. Refer to --> **Test Data, Spark Plugs** • Check the intake system for leaks. • Check fuel pressure	• Emission threshold percent misfire>1% • Catalyst damage (T>950°C) Rate >2.5 48 %	• Load changes within 2 revolutions 148 - 431%/s • Time from engine start idle - 150 rpm + 1 camshaft revolution • Engine load 0% max load • Engine speed range Idle 150 RPM-6700 RPM • Engine torque > 0 Nm • Speed change 3020-4200	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.
P0302	Cylinder 2 Misfire Detected	○ Check the fuel injector	• Emission threshold percent	• Load changes within 2	• 1000 Rev.	• 2 DCY • Immed.

		N31. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with Power Output Stage. Refer to --> **Ignition Coils with Power Output Stage , Checking**. ○ Check the Spark plugs. Refer to --> **Test Data, Spark Plugs** • Check the intake system for leaks. • Check fuel pressure	misfire>1% • Catalyst damage (T>950°C) Rate >2.5 48 %	revolutions 148 - 431%/s • Time from engine start idle - 150 rpm + 1 camshaft revolution • Engine load 0% max load • Engine speed rangeIdle 150 RPM-6700 RPM • Engine torque > 0 Nm • Speed change 3020-4200	• 200 Rev.	
P0303	Cylinder 3 Misfire Detected	○ Check the fuel injector N32. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with	• Emission threshold percent misfire>1% • Catalyst damage (T>950°C) Rate >2.5 48 %	• Load changes within 2 revolutions 148 - 431%/s • Time from engine start idle - 150 rpm + 1 camshaft	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.

		Power Output Stage. Refer to --> **Ignition Coils with Power Output Stage , Checking**. ○ Check the Spark plugs. Refer to --> **Test Data, Spark Plugs** • Check the intake system for leaks. • Check fuel pressure		revolution • Engine load 0% max load • Engine speed rangeIdle 150 RPM-6700 RPM • Engine torque > 0 Nm • Speed change 3020-4200		
P0304	Cylinder 4 Misfire Detected	○ Check the fuel injector N33. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with Power Output Stage. Refer to --> **Ignition Coils with Power Output**	• Emission threshold percent misfire>1% • Catalyst damage (T>950°C) Rate >2.5 48 %	• Load changes within 2 revolutions 148 - 431%/s • Time from engine start idle - 150 rpm + 1 camshaft revolution • Engine load 0% max load • Engine speed rangeIdle	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.

		Stage , Checking. ○ Check the Spark plugs. Refer to --> **Test Data, Spark Plugs** • Check the intake system for leaks. • Check fuel pressure		150 RPM-6700 RPM • Engine torque > 0 Nm • Speed change 3020-4200		
P0305	Cylinder 5 Misfire Detected	○ Check the fuel injector N83. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with Power Output Stage. Refer to --> **Ignition Coils with Power Output Stage , Checking**. ○ Check the Spark plugs. Refer to --> **Test**	• Emission threshold percent misfire>1% • Catalyst damage (T>950°C) Rate >2.5 48 %	• Load changes within 2 revolutions 148 - 431%/s • Time from engine start idle - 150 rpm + 1 camshaft revolution • Engine load 0% max load • Engine speed rangeIdle 150 RPM-6700 RPM • Engine torque > 0 Nm • Speed change	• 1000 Rev. • 200 Rev.	• 2 DCY • Immed.

		Data, Spark Plugs - Check the intake system for leaks. - Check fuel pressure		3020-4200		
P0306	Cylinder 6 Misfire Detected	○ Check the fuel injector N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Ignition Coil with Power Output Stage. Refer to --> **Ignition Coils with Power Output Stage , Checking**. ○ Check the Spark plugs. Refer to --> **Test Data, Spark Plugs** - Check the intake system for leaks.	- Emission threshold percent misfire>1% - Catalyst damage (T>950°C) Rate >2.5 48 %	- Load changes within 2 revolutions 148 - 431%/s - Time from engine start idle - 150 rpm + 1 camshaft revolution - Engine load 0% max load - Engine speed rangeIdle 150 RPM-6700 RPM - Engine torque > 0 Nm - Speed change 3020-4200	- 1000 Rev. - 200 Rev.	- 2 DCY - Immed.

		Check fuel pressure				
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	Check the Engine Speed (RPM) Sensor G28. Refer to --> **Engine Speed (RPM) Sensor G28 , Checking**.	Comparison of counted teeth and number of teeth +/- 1 tooth	---	0.1 Sec	2 DCY
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	Check the Engine Speed (RPM) Sensor G28. Refer to --> **Engine Speed (RPM) Sensor G28 , Checking**.	Comparison with phase sensor signal No engine speed signal	---	5 Sec	Immediate
P0340	Camshaft Position Sensor A Circuit (Bank 1, or single sensor)	Check the Camshaft Position (CMP) Sensor G40. Refer to **Camshaft Position (CMP) Sensor G40 , checking**.	Comparison to engine speed sensor (adaptation) Adaptation values at limit > 30° KW or -30° KW	Engine speed range 600 - 1520 RPM ECT - > 59.25°C	2 Sec	2 DCY
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or single	Check the Camshaft Position	Comparison to engine speed	---	0.5 Sec	2 DCY

	sensor)	(CMP) Sensor G40. Refer to **Camshaft Position (CMP) Sensor G40 , checking**.	sensor • No alternating signal at reference gap			
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1 or single sensor)	○ Check the Camshaft Position (CMP) Sensor G40. Refer to **Camshaft Position (CMP) Sensor G40 , checking**.	• Comparison to engine speed sensor • Signal low during 12 crankshaft Revs.	---	0.5 Sec	• 2 DCY
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1 or single sensor)	○ Check the Camshaft Position (CMP) Sensor G40. Refer to **Camshaft Position (CMP) Sensor G40 , checking**.	• Comparison to engine speed sensor • Signal low during 12 crankshaft Revs.	---	5 Sec	• 2 DCY
P0345	Camshaft Position Sensor A Circuit (Bank 2)	○ Check the Camshaft Position (CMP) Sensor G40. Refer to **Camshaft Position (CMP)**	• Comparison to engine speed sensor (adaptation) • Adaptation values at limit > 30° KW or -30° KW	• Engine speed range 600 - 1520 RPM • ECT - > 59.25°C	2 Sec	• 2 DCY

		Sensor G40 , checking.				
P0346	Camshaft Position Sensor A Circuit Range/Performance (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 2 G163. Refer to **Camshaft Position (CMP) Sensor 2 G163 , checking**.	- Comparison to engine speed sensor - No alternating signal at reference gap	---	0.5 Sec	- 2 DCY
P0347	Camshaft Position Sensor A Circuit Low Input (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 2 G163. Refer to **Camshaft Position (CMP) Sensor 2 G163 , checking**.	- Comparison to engine speed sensor - Signal low during 12 crankshaft Revs.	---	0.5 Sec	- 2 DCY
P0348	Camshaft Position Sensor A Circuit High Input (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 2 G163. Refer to **Camshaft Position (CMP) Sensor 2 G163 , checking**.	- Comparison to engine speed sensor - Signal low during 12 crankshaft Revs.	---	0.5 Sec	- 2 DCY
P0351	Ignition Coil A Primary/Secondary Circuit	○ Check the Ignition Coil with Power	- Short to battery + 5.2 - 8 A	- Engine speed - > 80 RPM	0.5 Sec	- 2 DCY

		Output Stage N70. Refer to --> **Ignition Coils with Power Output Stage , Checking**.	- Short to ground 0.5-1V - Open circuit 5 8.8V	- Battery Voltage 9.0-16.05V		
P0352	Ignition Coil B Primary/Secondary Circuit - (BGN only)	○ Check the Ignition Coil with Power Output Stage N127. Refer to --> **Ignition Coils with Power Output Stage , Checking**.	- Short to battery + 5.2 - 8 A - Short to ground 0.5-1V - Open circuit 5 8.8V	- Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V	0.5 Sec	- 2 DCY
P0353	Ignition Coil C Primary/Secondary Circuit - (BGN only)	○ Check the Ignition Coil with Power Output Stage N291. Refer to --> **Ignition Coils with Power Output Stage , Checking**.	- Short to battery + 5.2 - 8 A - Short to ground 0.5-1V - Open circuit 5 8.8V	- Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V	0.5 Sec	- 2 DCY
P0354	Ignition Coil D Primary/Secondary Circuit - (BGN only)	○ Check the Ignition Coil with Power Output Stage N292. Refer to --	- Short to battery + 5.2 - 8 A - Short to ground 0.5-1V - Open	- Engine speed - > 80 RPM - Battery Voltage 9.0-16.05V	0.5 Sec	- 2 DCY

		> **Ignition Coils with Power Output Stage , Checking**.	circuit 5 8.8V			
P0355	Ignition Coil "E" Primary/Secondary Circuit • (BGN only)	○ Check the Ignition Coil with Power Output Stage N323. Refer to --> **Ignition Coils with Power Output Stage , Checking**.	• Short to battery + 5.2 - 8 A • Short to ground 0.5-1V • Open circuit 5 8.8V	• Engine speed - > 80 RPM • Battery Voltage 9.0-16.05V	0.5 Sec	• 2 DCY
P0356	Ignition Coil "F" Primary/Secondary Circuit	○ Check the Ignition Coil with Power Output Stage N324. Refer to --> **Ignition Coils with Power Output Stage , Checking**.	• Short to battery + 5.2 - 8 A • Short to ground 0.5-1V • Open circuit 5 8.8V	• Engine speed - > 80 RPM • Battery Voltage 9.0-16.05V	0.5 Sec	• 2 DCY
P0365	Camshaft Position Sensor "B" Circuit (Bank 1)	○ Check the Camshaft Position (CMP) Sensor 3 G300.	• Comparison to engine speed sensor (adaptation) • Adaptation values at limit > 30° KW or -30° KW	• Engine speed range 600 - 1520 RPM • ECT - > 59.25°C	2 Sec	• 2 DCY
P0366	Camshaft Position Sensor "B" Circuit	○ Check the	• Comparison	---	0.5 Sec	• 2 DCY

	Range/Performance (Bank 1)	Camshaft Position (CMP) Sensor 3 G300.	to engine speed sensor (adaptation) • Adaptation values at limit > 30° KW or -30° KW			
P0367	Camshaft Position Sensor "B" Circuit Low (Bank 1)	○ Check the Camshaft Position (CMP) Sensor 3 G300.	• Comparison to engine speed sensor • Signal low during 12 crankshaft Revs.	---	0.5 Sec	• 2 DCY
P0368	Camshaft Position Sensor "B" Circuit High (Bank 1)	○ Check the Camshaft Position (CMP) Sensor 3 G300.	• Comparison to engine speed sensor • Signal low during 12 crankshaft Revs.	---	0.5 Sec	• 2 DCY
P0390	Camshaft Position Sensor "B" Circuit (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 4 G301. Refer to **Camshaft Position (CMP) Sensor 4 G301 , checking**.	• Comparison to engine speed sensor (adaptation) • Adaptation values at limit > 30° KW or -30° KW	• Engine speed range 600 - 1520 RPM • ECT - > 59.25°C	2 Sec	• 2 DCY
P0391	Camshaft Position Sensor "B" Circuit Range/Performance (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 4 G301. Refer to	• Comparison to engine speed sensor • No alternating	---	0.5 Sec	• 2 DCY

		Camshaft Position (CMP) Sensor 4 G301 , checking.	signal at reference gap			
P0392	Camshaft Position Sensor "B" Circuit Low (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 4 G301. Refer to **Camshaft Position (CMP) Sensor 4 G301 , checking**.	• Comparison to engine speed sensor • Signal low during 12 crankshaft Revs.	---	0.5 Sec	• 2 DCY
P0393	Camshaft Position Sensor "B" Circuit High (Bank 2)	○ Check the Camshaft Position (CMP) Sensor 4 G301. Refer to **Camshaft Position (CMP) Sensor 4 G301 , checking**.	• Comparison to engine speed sensor • Signal low during 12 crankshaft Revs.	---	0.5 Sec	• 2 DCY

Additional exhaust regulation

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency checks, MI Illuminatio
P0413	Secondary Air Injection System Switching Valve "A" Circuit Open	○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to --> **Secondary Air Injection**	• Open circuit 4.5 5.5V	• Air valve Off • Engine speed - >80 RPM • Battery voltage 9.0 16.05 V	0.5 Sec	• 2 DC

		(AIR) Pump Relay J299 , Checking.				
P0414	Secondary Air Injection System Switching Valve "A" Circuit Shorted	○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to --> **Secondary Air Injection (AIR) Pump Relay J299 , Checking**.	• Short to ground - 3 V • Short to Battery+2.2 - 4.0 A	• Air valve Off • Engine speed - >80 RPM • Battery voltage 9.0 16.05 V • Air valve On • Engine speed - >80 RPM • Battery voltage 9.0 16.05 V	0.5 Sec	• 2 DC
P0418	Secondary Air Injection System Control "A" Circuit	○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to --> **Secondary Air Injection (AIR) Pump Relay J299 , Checking**.	• Short to ground - 3 V • Open circuit 4.5 5.5 V • Short to Battery+2.2 - 4.0 A	• Air valve Off • Engine speed - >80 RPM • Battery voltage 9.0 16.05 V • Air valve On • Engine speed - >80 RPM • Battery voltage 9.0 16.05 V	0.5 Sec	• 2 DC
P0421	Warm Up Catalyst Efficiency Below Threshold (Bank 1)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the	AR > 0.3	• Catalyst temperature - 530-750°C • Engine start temp > - 9.75°C • Misfire rate 5% • Engine speed, 1080-2600 RPM	60 Sec/Once/DCY	• Once/ • 2 DC

		Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**. ○ Check the oxygen sensors behind Three Way Catalytic Converter (TWC). Refer to --> **Oxygen Sensor Heater behind Three Way Catalytic Converter (TWC) , Checking**. ○ Check the Three Way Catalytic Converter (TWC). Refer to --> **Three Way Catalytic Converter, Checking**.		• Air mass - 25-85 kg/h • O2 sensor No fault • Carbon canister load -Low		
P0431	Warm Up Catalyst Efficiency Below Threshold (Bank 2)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated**	AR > 0.3	• Catalyst temperature - 530-750°C • Engine start temp > - 9.75°C	60 Sec/Once/DCY	• 2 DC

		Oxygen Sensor (HO2S) G39 , checking. ○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**. ○ Check the oxygen sensors behind Three Way Catalytic Converter (TWC). Refer to --> **Oxygen Sensor Heater behind Three Way Catalytic Converter (TWC) , Checking**. ○ Check the Three Way Catalytic Converter (TWC). Refer to --> **Three Way Catalytic Converter, Checking**.		• Misfire rate 5% • Engine speed, 1080-2600 RPM • Air mass - 25-85 kg/h • O2 sensor No fault • Carbon canister load -Low		
P0441	Evaporative				20.5 Sec.	

	Emission System Incorrect Purge Flow	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.	• Reaction of idle controller or lambda controller • Deviation less than: 5 % lambda contr. and 40 % idle control	• Engine speed, Idle • Altitude, 2600 M • Time after engine start, >600 Sec • Coolant temperature >59.25°C or Substitute temp.>69.75° C • Or Substitute temperature, > 60°C • Lambda Control, Closed Loop • Lambda Control, Within sufficient range: not at max-threshold value and not at min + threshold value • Delta engine speed 100/min	Once/DCY	• 2 DC
P0442	Evaporative Emission System Leak Detected (Small Leak)	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to -->	• Pressure drop within predetermined time • 2.4 2.95 sec. Depending on altitude	• Purge Valve-Closed • LDP, Activated • Altitude, 2600 m • delta Ambient	Max 140 Sec. Once/DCY	• 2 DC

		EVAP Canister Purge Regulator Valve N80, Checking. ○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.		pressure 3 hPa • Restart temperature difference 50K • Time after engine start > 225 - 1500 sec. • Intake vacuum pressure > 150 hPa • Engine temperature 5 - 112°C • Vehicle speed > 6 mph • Selected gear - Any drive		
P0444	Evaporative Emission System Purge Control Valve Circuit Open	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the Leak Detection	Open Circuit 4.5 5.5 V	• EVAP purge valve - Off • Engine speed - > 80 rpm • Battery voltage 9.0 - 16.05 V	0.5 Sec	• 2 DC

		Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.				
P0445	Evaporative Emission System Purge Control Valve Circuit Shorted • (AVK only)	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission	• Short to battery +2.2 - 4 A • Short to ground 3 V	• EVAP purge valve - on • Engine speed - > 80 rpm • Battery voltage 9.0 - 16.05 V • EVAP purge valve - Off • Engine speed - > 80 rpm • Battery voltage 9.0 - 16.05 V	0.5 Sec	• 2 DC

		(EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.				
P0455	Evaporative Emission System Leak Detected (Large Leak)	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.	- Pressure drop within predetermined time 0.95 1.15 sec. Depending on altitude	- Purge Valve, Closed - LDP-Activated - Altitude, 2600 m - delta Ambient pressure 3 hPa - Restart temperature difference 50K - Time after engine start > 225 - 1500 sec. - Intake vacuum pressure > 150 hPa - Engine temperature 5 - 112°C - Vehicle speed > 6 mph - Selected gear - Any drive	- Max 140 Sec. Once/DCY - 280 Sec. Once/DCY	- 2 DC

P0456	Evaporative Emission System Leak Detected (very small leak)	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.	Pressure drop within predetermined time 2.95 7 sec. Depending on altitude	• Purge Valve-Closed • LDP-Activated • Altitude, 2600 m • delta Ambient pressure 2 hPa • Restart temperature difference 50K • Time after engine start > 225 - 1500 sec. • Intake vacuum pressure > 150 hPa • Engine temperature 5 - 112°C • Vehicle speed > 80.7 mph • Selected gear - Any drive • Acceleration - 2.1m/s2 • Deceleration - >2.1m/s2	Max 140 Sec. Once/DCY	• 2 DC
P0458	Evaporative Emission System Purge Control Valve	○ Check the Evaporative Emission (EVAP) Canister Purge	Signal voltage 3.0 V	• EVAP purge valve Commanded off • Engine speed	0.5 Sec	• Conti • 2 DC

	Circuit Low • (BGN only)	Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.		>80 RPM		
P0459	Evaporative Emission System Purge Control Valve Circuit High • (BGN only)	○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**.	Signal current > 2.2 4.0 A	• EVAP purge valve Commanded on • Engine speed >80 RPM	0.5 Sec	• Conti • 2 DC

		○ Check the Leak Detection Pump (LDP) V144. Refer to --> **Leak Detection Pump V144, Checking**. ○ Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to --> **EVAP System, Checking for Leaks**.				
P0491	Secondary Air Injection System Insufficient Flow Bank 1	○ Check the Secondary Air System for proper seal. Refer to --> **Combination Valve for Secondary Air Injection (AIR), Checking Function**. ○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to --> **Secondary Air Injection (AIR) Pump Relay J299 , Checking**.	• System too rich Ratio 30% • Statistical reflection Average of 6 • System too rich Checks 0.45	• Air mass flow 10 - 50 kg/h • Altitude - 2600 m • ECT - > 5 - 112°C • Catalyst temp. 720°C • Vehicle speed - > 6 mph • Time after engine start 121 Sec. • Engine load - Idle	• 5 - 14 Sec • Once/DCY	• 2 DC

P0492	Secondary Air Injection System Insufficient Flow Bank 2	○ Check the Secondary Air System for proper seal. Refer to --> **Combination Valve for Secondary Air Injection (AIR), Checking Function**. ○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to --> **Secondary Air Injection (AIR) Pump Relay J299 , Checking**.	• System too rich Ratio 30% • Statistical reflection Average of 6 • System too rich Checks 0.45	• Air mass flow 10 - 50 kg/h • Altitude - 2600 m • ECT - > 5 - 112°C • Catalyst temp. 720°C • Vehicle speed - > 6 mph • Time after engine start 121 Sec. • Engine load - Idle	• 5 - 14 Sec • Once/DCY	• 2 DC

Speed and idle control

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0501	Vehicle Speed Sensor A Range/Performance	○ Check the vehicle speed signal. Refer to --> **Speed Signal, Checking**.	VSS signal, 2.4 mph	• ECT - >39.75°C • Engine speed, 1520-4520 RPM	3 Sec	• 2 DCY
P0506	Idle Air Control System RPM Lower Than Expected	○ Check the Throttle Valve Control Module J338. Refer to --	• Idle correction deviation >100 RPM	• Engine speed, Idle • Vehicle speed, 0 mph	10 Sec	• 2 DCY

		> **Throttle Valve Control Module J338 , Checking**		• Accelerator position 0% • EVAP purge valve, Closed • Altitude, 2600 m • ECT, >-59.25°C		
P0507	Idle Air Control System RPM Higher Than Expected	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	• Idle correction deviation >200 RPM	• Engine speed, Idle • Vehicle speed, 0 mph • Accelerator position 0% • EVAP purge valve, Closed • Altitude, 2600 m • ECT, >-59.25°C	10 Sec	• 2 DCY

Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0600	Serial Communication Link • (AVK only)	Check CAN-Bus wiring from J285 Control Module in dash and ECM J220.	• Short to battery + • Short to ground. Core connection	Battery voltage - >10.7 V	0.5 Sec	

			• ECM no signal from can bus			
P0601	Internal Control Module Memory Check Sum Error	○ Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.	Internal check sum, incorrect	---	0.5 Sec	• 2 DCY
P0602	Control Module Programming Error	○ Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.	Message arriving from automatic transmission while ECU is calibrated for manual transmission.	Battery voltage - >10.7V	0.5 Sec	• 2 DCY
P0604	Internal Control Module Random Access Memory (RAM) Error	○ Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.	Write ability check, failed	---	0.5 Sec	• 2 DCY
P0605	Internal Control		Wrong check sum	---	0.5 Sec	

	Module Read Only Memory (ROM) Error	○ Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.				• 2 DCY
P0606	ECM/PCM Processor	○ Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.	• Short to battery + >4.88 V. Short to ground 0.14 V • 80% of max current longer than >0.6 Sec • Wrong value • Comparison with stored value • Other monitoring function out of range • Torque out of range	---	2 Sec • 0.6 Sec • 0.5 Sec	• 2 DCY
P0627	Fuel Pump A Control Circuit/Open • (BGN only)	Refer to --> **Fuel Supply System**	• Short to ground 3.0 V • Open circuit 4.5 5.5 V	Engine speed - > 80 RPM	0.5 Sec	• Continuous • 2 DCY
P0629	Fuel Pump A Control Circuit	Refer to --> **Fuel Supply System**	• Short to battery +	Engine speed - > 80 RPM	0.5 Sec	• Continuous

	High • (BGN only)		0.6 - 1.2 A			• 2 DCY
P0638	Throttle Actuator Control Range/Performance - Bank 1	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking** ○ Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) G187/Throttle Drive Angle Sensor 2 (for Electronic Power Control (EPC)) G188. Refer to --> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**.	• Open 15% t > 0.14 sec. • Then Close to 3% t > 0.56 sec. • Voltage ranges Sensor 1- 0.21 to 0.87 V. Sensor 2 - 4.14 to 4.84 V • Comparison of upper and lower reference points with stored limits	• Ignition on • Engine speed - 0 RPM • Intake air temp. - > 5°C • Vehicle speed - 0 mph • ECT - > 5°C	5 Sec	• 2 DCY
P0685	ECM/PCM Power Relay Control Circuit/Open	○ Check the voltage supply for Motronic Engine Control	• Open circuit. Control voltage >0.7 V	• Sense circuit voltage >4.0 V	0.5 Sec	• 2 DCY

		Module (ECM) J220. Refer to --> **Voltage Supply, Checking**. ○ Check the activation of Engine Control Module (ECM) Power Supply Relay J271. Refer to --> **Motronic Engine Control Module (ECM) Power Supply Relay J271 , Checking**.				
P0686	ECM/PCM Power Relay Control Circuit Low	○ Check the voltage supply for Motronic Engine Control Module (ECM) J220. Refer to --> **Voltage Supply, Checking**. ○ Check the activation of Engine Control Module (ECM) Power Supply Relay J271. Refer to --> **Motronic Engine Control**	• Short to ground. Control voltage 0.51 V	• Sense circuit voltage >5.5V	0.5 Sec	• 2 DCY

		Module (ECM) Power Supply Relay J271 , Checking.				
P0687	ECM/PCM Power Relay Control Circuit High	○ Check the voltage supply for Motronic Engine Control Module (ECM) J220. Refer to --> **Voltage Supply, Checking**. ○ Check the activation of Engine Control Module (ECM) Power Supply Relay J271. Refer to --> **Motronic Engine Control Module (ECM) Power Supply Relay J271 , Checking**.	• Short to battery +. Control voltage >4.0 V	• Sense circuit voltage >4.0V	0.5 Sec	• 2 DCY
P0688	ECM/PCM Power Relay Sense Circuit/Open	○ Check the voltage supply for Motronic Engine Control Module (ECM) J220. Refer to --> **Voltage Supply,**	• Voltage too low 4.0 V	• Main relay - On	0.5 Sec	• 2 DCY

		Checking. ○ Check the activation of Engine Control Module (ECM) Power Supply Relay J271. Refer to --> **Motronic Engine Control Module (ECM) Power Supply Relay J271 , Checking**.				

02E Transmission

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitorin Time Length
P0701	Transmission control system range/performance	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND	Travel sensor voltage gearshift fork 1/3 out of plausibility range voltage 300 mV or voltage > 4700 mV	---	300 ms

		ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .			
P0702	Transmission control system electrical	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE	In spite of the cut-off of the Common High-side Switch 1, a measurable current is present In spite of the turned on Common High-side switch 1, no current is measurable CHS 1 cut-off and CHS 1 Current is > 40 mA CHS 1 turned on and CHS 1 Current is 200 mA	• Terminal 15 voltage 18 V • Battery voltage > 9 V for more than 500 ms	300 ms

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P0729	Gear 6 incorrect ratio	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	Calculate the speed of input shaft 2 with the sixth gear ratio and the output shaft speed Compare the calculated speed with measured speed of input shaft 2 Speed difference magnitude > 50 RPM for more than 120 ms	• Control safety valve 2 (on) >=20% • Multiplexer position ==0 • Control gearshift fork valve 3 >= 5% • Terminal 15 V > 4 V for more than 500 ms • Battery voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	120 ms
P0731	Gear 1 incorrect ratio	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION	• Calculate the speed of input shaft 1 with the first gear ratio and the output shaft speed • Compare the calculated speed with measured	• Control safety valve 2 (on) >=20% • Multiplexer position ==0 • Control gearshift fork valve 3	120 ms

		01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	speed of input shaft 1 - Speed difference magnitude > 50 RPM for more than 120 ms	>= 5% - Terminal 15 V > 4 V for more than 500 ms - Battery voltage > 9 V for more than 500 ms - Engine speed > 600 RPM for more than 500 ms	
P0732	Gear 2 incorrect ratio	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL	- Calculate the speed of input shaft 2 with the second gear ratio and the output shaft speed - Compare the calculated speed with measured speed of input shaft 2 - Speed difference magnitude > 50 RPM for more than 120 ms	- Control safety valve 2 (on) >=20% - Multiplexer position ==0 - Control gearshift fork valve 3 >= 5% - Terminal 15 V > 4 V for more than 500 ms - Battery voltage > 9 V for more than 500 ms - Engine	120 ms

		DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .		speed > 600 RPM for more than 500 ms	
P0733	Gear 3 incorrect ratio	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE	- Calculate the speed of input shaft 1 with the third gear ratio and the output shaft speed - Compare the calculated speed with measured speed of input shaft 1 - Speed difference magnitude > 50 RPM for more than 120 ms	- Control safety valve 2 (on) >=20% - Multiplexer position ==0 - Control gearshift fork valve 3 >= 5% - Terminal 15 V > 4 V for more than 500 ms - Battery voltage > 9 V for more than 500 ms - Engine speed > 600 RPM for more than 500 ms	120 ms

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P0734	Gear 4 incorrect ratio	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	- Calculate the speed of input shaft 2 with the fourth gear ratio and the output shaft speed - Compare the calculated speed with measured speed of input shaft 2 - Speed difference magnitude > 50 RPM for more than 120 ms	- Control safety valve 2 (on) >=20% - Multiplexer position ==0 - Control gearshift fork valve 4 >= 5% - Terminal 15 V > 4 V for more than 500 ms - Battery voltage > 9 V for more than 500 ms - Engine speed > 600 RPM for more than 500 ms	120 ms
P0735	Gear 5 incorrect ratio	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION	- Calculate the speed of input shaft 1 with the fifth gear ratio and the output shaft speed - Compare the calculated speed with measured	- Control safety valve 2 (on) >=20% - Multiplexer position ==0 - Control gearshift fork valve 1	120 ms

		01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	speed of input shaft 1 • Speed difference magnitude > 50 RPM for more than 120 ms	>= 5% • Terminal 15 V > 4 V for more than 500 ms • Battery voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	
P0736	Reverse incorrect ratio	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL	• Calculate the speed of input shaft 1 with the fifth gear ratio and the output shaft speed • Compare the calculated speed with measured speed of input shaft 1 • Speed difference magnitude > 50 RPM for more than 120 ms • Gearshift fork of reverse gear	• Control safety valve 2 (on) >=20% • Multiplexer position ==0 • Control gearshift fork valve 4 >= 5% • Terminal 15 V > 4 V for more than 500 ms • Battery voltage > 9 V for more than 500 ms • Engine	120 ms • 6 Se

		DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	stays in shifted position in spite of command to disengage - Gearshift fork position synchronizing point fifth gear -10% - Synchronizing point measured by a basic adjustment (reverse gear stays in shifted position) - Control valve gearshift fork valve 3 >= 5%	speed > 600 RPM for more than 500 ms	
P0746	Pressure control solenoid A performance or stuck off	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL	- Desired valve current of clutch 1 exceeds a threshold - The same time, the actual valve current is smaller than a second threshold - Desired current > 350 mA; actual current 50 mA	Terminal 15 voltage > 4 V for more than 500 ms	300 ms

		COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .			
P0746	Pressure control solenoid A performance or stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	• Integral of actual pressure minus desired pressure minus drain exceeds a maximum value • Pressure integral >= 0.1 bars	• Desired pressure = adapted clutch slipping point + 1 bar • Standing vehicle with accelerator pedal 1.5% • Battery voltage > 9 V for more than 500 ms • Engine speed >600 RPM for more than 500 ms	500 ms
P0747	Pressure control	○ Refer to	• Comparison of	• Common	200 ms

	solenoid A stuck on	• **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	actual valve current with desired valve current of clutch 1 • Actual current > desired current, and (actual current - desired current) > 200 mA for more than 200 ms	high-side switch 1 on and not defective • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2 • Terminal 15 voltage > 4 V for more than 500 ms	
P0751	Shift solenoid A performance or stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 -**	• Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 - actual current of clutch 1) at switching point of control gearshift fork	• Common high-side switch 1 and 3 on and no defects • Gearbox subsystem 1 active • Common high-side switches not	300 ms

		AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	valve 1 with residual current at permanent control of control gearshift fork valve 1 • Difference of residual current = 200 mA (supply voltage at common high-side 1 = 7 V). 450 mA (supply voltage at common high-side 1 = 13 V)	deactivated by module 2 • Duty factor change of safety valve 1 (control of safety valve 1 is stable) = 5% • Duty factor change of gearshift fork valve 2 (control of gearshift fork valve 2 is stable) = 5% • Duty factor of control gearshift fork valve 1 >70% and steady state time >= 50 ms • Terminal 15 voltage > 4 V for more than 500 ms	
P0756	Shift solenoid B performance or stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION**	• Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 - actual current of clutch 1) at switching point of control gearshift fork valve 2 with	• Common high-side switch 1 and 3 on and no defects • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2	300 ms

		- GEARS, HYDRAULIC CONTROLS for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	residual current at permanent control of control gearshift fork valve 2 • Difference of residual current = 200 mA (supply voltage at common high-side 1 = 7 V).. 450 mA (supply voltage at common high-side 1 = 13 V)	• Duty factor change of safety valve 1 (control of safety valve 1 is stable) = 5% • Duty factor change of gearshift fork valve 1 (control of gearshift fork valve 1 is stable) = 5% • Duty factor of control gearshift fork valve 2 >70% and steady state time >= 50 ms • Terminal 15 voltage > 4 V for more than 500 ms	
P0761	Shift solenoid C performance or stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC**	• Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 - actual current of clutch 2) at switching point of control gearshift fork valve 3 with residual current at	• Common high-side switch 2 and 3 on, and no defects • Gearbox subsystem 2 active • Common high-side switches not deactivated by module 2 • Duty factor change of	300 ms

		CONTROLS for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE	permanent control of control gearshift fork valve 3 - Difference of residual current = 200 mA (supply voltage at common high-side 2 = 7 V).. 450 mA (supply voltage at common high-side 2 = 13 V)	safety valve 2 (control of safety valve 2 is stable) = 5% - Duty factor change of gearshift fork valve 4 (control of gearshift fork valve 4 is stable) = 5% - Duty factor of control gearshift fork valve 3 >70% and steady state time >= 50 ms terminal 15 voltage > 4 V for more than 500 ms	
P0766	Shift solenoid D performance or stuck off	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION	- Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 - actual current of clutch 2) at switching point of control gearshift fork valve 4 with residual current at permanent control of control gearshift fork valve 4	- Common high-side switch 2 and 3 on, and no defects - Gearbox subsystem 2 active - Common high-side switches not deactivated by module 2 - Duty factor change of safety valve 2 (control of safety valve 2 is stable) =	300 ms

		01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	- Difference of residual current = 200 mA (supply voltage at common high-side 2 = 7 V).. 450 mA (supply voltage at common high-side 2 = 13 V)	5% - Duty factor change of gearshift fork valve 3 (control of gearshift fork valve 3 is stable) = 5% - Duty factor of control gearshift fork valve 4 >70% and steady state time >= 50 ms - Terminal 15 voltage > 4 V for more than 500 ms	
P0771	Shift solenoid E performance or stuck off	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL	- Comparison of residual current of central control (total current at common high-side switch 3 - actual current of main pressure valve and cooling oil valve) at switching point of multiplexer valve with residual current at permanent control of multiplexer valve - Difference of	- Common high-side switch 3 on and no defects - Common high-side switches not deactivated by module 2 - Multiplexer valve is controlled and steady state time (>= 50 ms) - Terminal 15 voltage >4 V for more than 500 ms	300 ms

		DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	residual current = 150 mA (maximum of supply voltage at common high-side 1 and 2 and terminal 15 = 7 V) • 300 mA (maximum of supply voltage at common high-side 1 and 2 and terminal 15 = 13 V		
P0776	Pressure control solenoid B performance or stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD.	• Integral of actual pressure minus desired pressure, minus drain exceeds a maximum value • Pressure integral >= 0.1 bars	• Desired pressure = adapted clutch slipping point + 1 bar • Standing vehicle with accelerator pedal 1.5% • Battery voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	500 ms

		AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .			
P0776	Pressure control solenoid B performance or stuck off	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	- Desired valve current of clutch 2 exceeds a threshold - At the same time, the actual valve current is smaller than a second threshold - Desired current > 350 mA; actual current 50 mA	Terminal 15 voltage > 4 V for more than 500 ms	300 ms
P0777	Pressure control solenoid B stuck on	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC**	- Comparison of actual valve current with desired valve current of clutch 2	- Common high-side switch 2 on and not defective - Gearbox	200 ms

		CONTROLS for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	- Actual current > desired current, and (actual current - desired current) > 200 mA for more than 200 ms	subsystem 2 active - Common high-side switches not deactivated by module 2 - Terminal 15 voltage > 4 V for more than 500 ms	
P0781	1-2 shift	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD.	- Gearshift fork of first gear stays in shifted position in spite of command to disengage - Gearshift fork position > synchronizing point first gear + 10% - Synchronizing point measured by a basic adjustment (first gear stays	- Control safety valve 1 (on) >=20% - Multiplexer position ==0 - Desired main pressure > 2 bars - Terminal 15 V > 4 V for more than 500 ms - Battery	6 Sec

		AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	in shifted position) • Control gearshift fork valve 2>=5%	voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	
P0782	2-3 shift	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC	• Gear shift fork of second gear stays in shifted position in spite of command to disengage • Gearshift fork position synchronizing point second gear -10% • Synchronizing point measured by a basic adjustment (second gear stays in shifted position) • Control gearshift fork valve 4 >= 5%	• Control safety valve 2 (on) >=20% • Multiplexer position ==1 • Desired main pressure > 2 bars • Terminal 15 V > 4 V for more than 500 ms • Battery voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	6 Sec

		TRANSMISSION 09L ALL WHEEL DRIVE .			
P0783	3-4 shift	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	• Gearshift fork of third gear stays in shifted position in spite of command to disengage • Gearshift fork position synchronizing point third gear -10% • Synchronizing point measured by a basic adjustment (third gear stays in shifted position) • Control valve gearshift fork valve 1 >= 5%	• Control safety valve 1 (on) >=20% • Multiplexer position ==0 • Desired main pressure > 2 bars • Terminal 15 V > 4 V for more than 500 ms • Battery voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	6 Sec
P0784	4-5 shift	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5	• Gearshift fork of fourth gear stays in shifted position in spite of command to disengage	• Control safety valve 2 (on) >=20% • Multiplexer position ==1	6 Sec

		SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	• Gearshift fork position >synchronizing point fourth gear +10% • Synchronizing point measured by a basic adjustment (fourth gear stays in shifted position) • Control valve gearshift fork valve 3 >= 5%	• Desired main pressure > 2 bars • Terminal 15 V > 4 V for more than 500 ms • Battery voltage > 9 V for more than 500 ms • Engine speed > 600 RPM for more than 500 ms	
P0797	Pressure control solenoid C stuck on	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC	• Comparison of actual valve current with desired valve current of main pressure solenoid valve • Actual current > desired current, and (actual current - desired current) > 200 mA for more than 300 ms	• Common high-side switch 3 on and not defective • Common high-side switches not deactivated by module 2 • Terminal 15 voltage > 4 V for more than 500 ms	300 ms

		TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .			
P0829	5-6 shift	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION	- Gearshift fork of fifth gear stays in shifted position in spite of command to disengage - Gearshift fork position >synchronizing point fifth gear +10% - Synchronizing point measured by a basic adjustment (fifth gear stays in shifted position) - Control valve gearshift fork valve 2 >= 5%	- Control safety valve 1 (on) >=20% - Multiplexer position ==1 - Desired main pressure > 2 bars - Terminal 15 V > 4 V for more than 500 ms - Battery voltage > 9 V for more than 500 ms - Engine speed > 600 RPM for more than 500 ms	6 Sec

		09L ALL WHEEL DRIVE .			
P0840	Transmission fluid pressure sensor/switch A circuit	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	• Pressure sensor voltage clutch 1 out of plausibility range • Voltage 100 mV or voltage > 4900 mV	---	300 ms
P0841	Transmission fluid pressure sensor/switch A circuit range/performance	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD.	• Hydraulic pressure of clutch 1 exceeds a maximum value • Pressure >= 15.5 bars	• Signal range check is correct • Terminal 15 voltage >4 V for more than 500 ms	1 Second

		AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .		• Battery voltage >9 V for more than 500 ms	
P0845	Transmission fluid pressure sensor/switch B circuit	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION	• Pressure sensor voltage clutch 2 out of plausibility range • Voltage 100 mV or voltage > 4900 mV	---	300 ms

		01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .			
P0846	Transmission fluid pressure sensor/switch B circuit range/performance	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL	- Hydraulic pressure of clutch 2 exceeds a maximum value - Pressure >= 15.5 bars	- Signal range check is correct - Terminal 15 voltage >4 V for more than 500 ms - Battery voltage >9 V for more than 500 ms	1 Second

		DRIVE .			
P0864	TCM communication circuit range/performance	○ Check the CAN-Bus terminal resistance, Transmission Control Module (TCM) J217 to Motronic Engine Control Module (ECM) J220. Refer to --> **CAN-Bus Terminal Resistance, Transmission Control Module (TCM) J217 to Engine Control Module (ECM) J220 , Checking**	---	• Terminal 15 voltage > 9 V for more than 500 ms • > 500 ms after reset	80 ms
P0890	TCM power relay sense circuit low	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION	Detection by hardware circuit current >8.5 A	Terminal 15 voltage > 4 V for more than 500 ms	200 ms

		09L ALL WHEEL DRIVE .			
P0892	TCM Power Relay Sense Circuit Intermittent	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	Hardware detection	• Filtered battery voltage, > 7 V • High side and low side FET, enabled • Status counter initialization, 0 or 1	0.03 Sec
P0914	Gear shift position circuit	○ Check the selector mechanism. Refer to • **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD.	• Selector lever position is not equal to negation of the inverse selector lever position OR selector lever	• No bus off error • No error failure of all CAN messages • No failure of	1 Second

		AUTOMATIC TRANSMISSION 01V • **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **37 CONTROLS, HOUSING** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE • **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J • **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING	position equals initialization value OR selector lever position equals error value OR selector lever position is equal to negation of the inverse selector position but no valid position • Selector lever position =Position 1,2,3,4 OR L	selector lever CAN messages • Time after reset >1000 ms • Terminal 15 voltage > 9 V for more than 500 ms	

P0914	Gear shift position circuit	○ Check the selector mechanism. Refer to - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **37 CONTROLS, HOUSING** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for	- If time out of the question and answer diagnosis is detected, increment an event counter - Time out threshold > 100 ms	- Gear message for selector lever is transmittable and selector lever message is receivable - No failure of selector lever CAN messages - Terminal 15 voltage > 4 V for more than 500 ms	300 ms

		CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING .			
P0919	Gear shift position control error	○ Check the selector mechanism. Refer to - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **37 CONTROLS, HOUSING** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY	Error flag of not determinable selector lever position is set	- No failure of selector lever CAN messages - Terminal 15 voltage > 4 V for more than 500 ms - Battery voltage > 9 V for more than 500 ms	20 ms

		VARIABLE TRANSMISSION (CVT) 01J - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING .			
P0929	Gear shift lock solenoid control circuit range/performance	○ Check the selector mechanism. Refer to - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **37 CONTROLS, HOUSING** for 6 SPD. AUTOMATIC TRANSMISSION	If the shift-lock position signal is not valid (position != error, not active, active or init) increment an event counter	- No failure of selector lever CAN messages - Terminal 15 voltage > 4 V for more than 500 ms	20 ms

		09L ALL WHEEL DRIVE • **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J • **37 - AUTOMATIC TRANSMISSION - CONTROLS, HOUSING** for CONTINUOUSLY VARIABLE TRANSMISSION (CVT) 01J - INTERNAL COMPONENTS, SERVICING .			

SAE P1xxx Diagnostic Trouble Codes

Fuel and air mixture, additional emissions regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1081	Exhaust Bank 3, mixture adaptation range 1. Lower lean limit not reached • (AVK only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel**	• System too lean >+4% • Within adaptive range • System too rich - 4%	• Lamda Adaptation Active • Lambda control Closed loop • EVAP purge valve Closed	• 50 Sec. or if fuel tank empty or fuel gage defect: calculated air mass flow >200kg	• 2 DCY

		Injector , Checking. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator**		• Engine temp. - >70°C Or Substitute temp. >70°C • Time after start >351 sec. • Idle adaptation range: Engine speed 720/min • Air mass - 19kg/h • Part load adaptation Ready		

		Valve N80, Checking. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P1296	Malfunction in cooling system • (AVK only)	○ Check the Engine Coolant Temperature (ECT) Sensor G62. Refer to --> **Engine Coolant Temperature (ECT) Sensor G62 , Checking**. ○ Check the thermostat. Refer to **20 - FUEL SUPPLY SYSTEM** .	• Measured temp. >8.25 K Lower than model temp • Measured temp. 60° C	---	Once/DCY	• 2 DCY

SAE P2xxx Diagnostic Trouble Codes

Fuel and air mixture, additional emissions regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P2088	A Camshaft Position Actuator Control Circuit Low	○ Check the Camshaft Adjustment Valve 1	Signal voltage 3 V	• Camshaft valve - Off. Engine	0.5 Sec	• Continuous • 2 DCY

	Bank 1 • (BGN only)	N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.		speed > 80 RPM		
P2089	A Camshaft Position Actuator Control Circuit High Bank 1 • (BGN only)	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	Signal Voltage 2.2-8 A	• Camshaft valve - On • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY
P2090	"B" Camshaft Position Actuator Control Circuit Low Bank 1 • (BGN only)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	Signal voltage 3 V	• Camshaft valve - Off. Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY
P2091	"B" Camshaft Position Actuator Control Circuit High Bank 1 • (BGN only)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	Signal Voltage 2.2-8 A	• Camshaft valve - On • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY
P2092	A Camshaft Position	○ Check the Camshaft	Signal voltage 3 V	• Camshaft valve -	0.5 Sec	• Continuous

	Actuator Circuit (Bank 2) Short to ground - (BGN only)	Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.		Off. Engine speed > 80 RPM		- 2 DCY
P2093	A Camshaft Position Actuator Control Circuit (Bank 2) High - (BGN only)	○ Check the Camshaft Adjustment Valve 1 N205. Refer to **Camshaft Adjustment Valve 1 N205 , checking**.	Signal Voltage 2.2-8 A	- Camshaft valve - On - Engine speed > 80 RPM	0.5 Sec	- Continuous - 2 DCY
P2094	B Camshaft Position Actuator Circuit (Bank 2) Short to ground - (BGN only)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	Signal voltage 3 V	- Camshaft valve - off - Engine speed > 80 RPM	0.5 Sec	- Continuous - 2 DCY
P2095	B Camshaft Position Actuator Circuit (Bank 2) Short to B+ - (BGN only)	○ Check the Camshaft Adjustment Valve 1 (exhaust) N318. Refer to **Camshaft Adjustment Valve 1 (exhaust) N318 , checking**.	Signal Voltage 2.2-8A	- Camshaft valve - On - Engine speed > 80 RPM	0.5 Sec	- Continuous - 2 DCY

P2096	Post Catalyst Fuel trim System Too Lean Bank 1 • (BGN only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30,N31, N32, N33, N83, N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic**	Integral part of lambda control post cat. > - 0.03	• Lambda control Closed loop • Lambda control post cat. Closed loop • Engine speed 1000-3600 RPM • Engine load 18-56%	100 Sec	• Continuous • 2 DCY

		Converter (TWC) G130 , checking. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1) • (BGN only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30, N31, N32, N33,	Integral part of lambda control post cat. - 0.03	• Lambda control Closed loop • Lambda control post cat. Closed loop • Engine speed	100 Sec	• Continuous • 2 DCY

		N83, N84. Refer to --> **Fuel Injector , Checking**. - Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. - Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. - Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.		1000-3600 RPM - Engine load 18-56%		

		Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P2098	Post Catalyst Fuel trim System Too Lean (Bank 2) • (BGN only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated**	Integral part of lambda control post cat. > - 0.03	• Lambda control Closed loop • Lambda control post cat. Closed loop • Engine speed 1000-3600 RPM • Engine load 18-56%	100 Sec	• Continuous • 2 DCY

		Oxygen Sensor (HO2S) G39 , checking. o Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. o Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. o Check the intake system for leaks (false air).				

		○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				
P2099	Post Catalyst Fuel Trim System Too Rich (Bank 2) • (BGN only)	○ Check the fuel pressure. Refer to --> **Fuel Delivery, Checking**. ○ Check the fuel injectors N30, N31, N32, N33, N83, N84. Refer to --> **Fuel Injector , Checking**. ○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**. ○ Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter	Integral part of lambda control post cat. - 0.03	• Lambda control Closed loop • Lambda control post cat. Closed loop • Engine speed 1000-3600 RPM • Engine load 18-56%	100 Sec	• Continuous • 2 DCY

		(TWC) G130. Refer to **Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 , checking**. ○ Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80. Refer to --> **EVAP Canister Purge Regulator Valve N80, Checking**. ○ Check the intake system for leaks (false air). ○ Check the exhaust system for proper seal. ○ Check the vacuum lines for leaks				

Fuel and air ratio

DTC	Error Message	Diagnostic	Malfunction	Secondary	Monitoring	Frequency

		Procedure	Criteria and Threshold Value	Parameters with Enable Conditions	Time Length	checks, MI Illuminatio
P2101	Throttle Actuator Control Motor Circuit Range/Performance	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	• >80% of maximum duty cycle • Throttle valve angle deviation >0.6 sec.	---	5 Sec	• Conti • 2 DC
P2106	Throttle Actuator Control System - Forced Limited Power • (BGN only)	○ Check the Throttle Valve Control Module J338. Refer to --> **Throttle Valve Control Module J338 , Checking**	Duty cycle, >80% and ECM power stage, failure.	---	5 Sec	• Conti • 2 DC
P2122	Throttle/Pedal Position Sensor/Switch D Circuit Low Input	○ Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) G187/Throttle Drive Angle Sensor 2 (for Electronic Power Control (EPC)) G188. Refer to --> **Throttle Position Sensor G79 and Accelerator**	Lower threshold 0.63 V	Sensor voltage 2 (2 times) >1.15	0.2 Sec	• 2 DC

		Pedal Position Sensor 2 G185, Checking.				
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input	○ Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) G187/Throttle Drive Angle Sensor 2 (for Electronic Power Control (EPC)) G188. Refer to --> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**.	Upper threshold> 4.82 V	---	0.2 Sec	• 2 DC
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input	○ Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) G187/Throttle Drive Angle Sensor 2 (for Electronic Power Control (EPC)) G188.	Lower threshold 0.43 V	Sensor voltage 1 (2 times) >1.15	0.2 Sec	• 2 DC

		Refer to --> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**.				
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input	○ Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) G187/Throttle Drive Angle Sensor 2 (for Electronic Power Control (EPC)) G188. Refer to --> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**.	Upper threshold> 4.94 V		0.2 Sec	• 2 DCY
P2138	Throttle/Pedal Position Sensor/Switch D/E Voltage Correlation	○ Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) G187/Throttle	Comparison signal sensor 1 vs. sensor 2 delta > 0.21 - 1.11 V	Sensor voltage 1 Sensor voltage 2 (2 times) > 0.84 V	0.24 Sec	• 2 DCY

		Drive Angle Sensor 2 (for Electronic Power Control (EPC)) G188. Refer to --> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**.				
P2181	Cooling System Performance - (BGN only)	○ Check the Engine Coolant Temperature (ECT) Sensor G62. Refer to --> **Engine Coolant Temperature (ECT) Sensor G62 , Checking**. ○ Check the thermostat. Refer to **20 - FUEL SUPPLY SYSTEM** .	- ECT 81°C - @ Mass air integral 10.7-15.1kg	- ECT at start 4.5-30°C - Accum. fuel cut off 120 sec. - Delta ambient pressure 1.5 kPa - Average value: Vehicle speed 22-75 mph - Mass air flow >50-100 kg/h - Mass air flow 100-200 kg/h	2 Sec	- Once/ - 2 DC
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1) - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated**	- Lambda value, >1.07 and O2S signal rear, >0.75 V - Lambda	- Lambda control Closed loop - O2S rear - ready	200 Sec	- Conti - 2 DC

		Oxygen Sensor (HO2S) G39 , checking.	control, at max. value • Exhaust mass air integral, > 0.2-0.8 kg • O2S signal rear, >0.75 V • Lambda control, not at max. value • P-portion of 2nd control loop >0.01 And • P-portion and I-portion of 2nd control loop, trim to lean	• Lambda control Closed loop • O2S rear Ready • Lambda control post catalyst - Closed loop • O2S rear signal check Ready		
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	• Lambda value, 0.90 and O2S signal rear, 0.153 V • Lambda control, at min. value • Exhaust mass air integral, > 0.20 kg • O2S signal rear, 0.15 V • P-portion of 2nd lambda control loop >0.01 And	• Lambda control Closed loop • O2S rear - ready • Lambda control Closed loop • O2S rear Ready • Lambda control post catalyst - Closed loop • O2S rear signal check Ready	200 Sec	• Conti • 2 DCY

			• P-portion and I-portion of 2nd lambda control loop, trim to rich			
P2197	O2 Sensor Signal Biased/Stuck Lean (Bank 2 Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	• Lambda value, >1.07 and O2S signal rear, >0.75 V • Lambda control, at max. value • Exhaust mass air integral, > 0.2-0.8 kg • O2S signal rear, >0.75 V • Lambda control, not at max. value • P-portion of 2nd control loop >0.01 And • P-portion and I-portion of 2nd control loop, trim to lean	• Lambda control Closed loop • O2S rear - ready • Lambda control Closed loop • O2S rear Ready • Lambda control post catalyst - Closed loop • O2S rear signal check Ready	200 Sec	• Conti • 2 DC
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1 • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to	Delta O2S signal front,>0.2-0.3 V. 30 times.	• O2S ceramic temp. >750+/-65° C • Modeled	50 Sec	• Conti • 2 DC

		Heated Oxygen Sensor (HO2S) G39 , checking.		exhaust gas temp. 800°C - Heater duty cycle >5% - Delta engine load 3% - Catalyst heating Not active - SAI Not active		
P2234	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 2 Sensor 1 - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	Delta O2S signal front,>0.2-0.3 V. 30 times.	- O2S ceramic temp. >750+/-65° C - Modeled exhaust gas temp. 800°C - Heater duty cycle >5% - Delta engine load 3% - Catalyst heating Not active - SAI Not active	50 Sec	- Contir - 2 DC
P2237	O2 Sensor Positive Current Control Circuit/Open - Bank 1, Sensor 1 - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	- O2S signal front 1.49-1.51 V - Lambda value setting 0.95 or - Lambda value setting>1.05 - Mass air	- Lambda control Closed loop - O2S ceramic temp. - 750+/-65°C - Electrical adjustment - Not active - Lambda	30 Sec - 5 Sec - 5 Sec	- Contir - 2 DC

			integral >0.2kg Fuel cut off >5 sec. O2S signal front 2.8 V Enrichment or lean out Active O2S signal front 1.49-1.51 V Delta lambda value setting >0.02 V	control Closed loop Heater control Closed loop O2S ceramic temp. 750+/-65°C Electrical adjustment Not active O2S ceramic temp.750+/-65°C		
P2240	O2 Sensor Positive Current Control Circuit/Open Bank 2 Sensor 1 (BGN only)	Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	O2S signal front 1.49-1.51 V Lambda value setting0.95 or Lambda value setting >1.05 Mass air integral >0.2kg Fuel cut off >5 sec. O2S signal front 2.8 V Enrichment or lean out Active O2S signal	Lambda control Closed loop O2S ceramic temp. - 750+/-65°C Electrical adjustment - Not active Lambda control Closed loop Heater control Closed loop O2S ceramic temp.750+/-65°C Electrical adjustment	30 Sec 5 Sec 5 Sec	Conti 2 DC

			front1.49-1.51 V - Delta lambda value setting >0.02 V	Not active - O2S ceramic temp.750+/-65°C - Heater control Closed loop - O2S ceramic temp. 750+/-65°C - Electrical adjustment Not active - O2S ceramic temp.750+/-65°C		
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank1, Sensor 1) - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	- O2S signal front, >4.7 V and - Internal resistance, >570ohms or - O2S signal front, 0.2 V and - Internal resistance, >570ohms	Heater control - Active	22 Sec	- Conti - 2 DC
P2247	O2 Sensor Reference Voltage Circuit/Open (Bank 2, Sensor 1) - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2**	- O2S signal front,>4.7 V and - Internal resistance, >570ohms or - O2S signal front, 0.2 V	Heater control - Active	22 Sec	- Conti - 2 DC

		G108 , checking.	and • Internal resistance, >570ohms			
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1, Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	• O2S signal front, 1.5 V and • Internal resistance, >570ohms • Number of heater coupling faults - >4	• Heater control - Active • Modeled exhaust temp. 900°C	50 Sec	• Contir • 2 DCY
P2254	O2 Sensor Negative Current Control Circuit/Open (Bank 1, Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	• O2S signal front, 1.5 V and • Internal resistance, >570ohms • Number of heater coupling faults - >4	• Heater control - Active • Modeled exhaust temp. 900°C	50 Sec	• Contir • 2 DCY
P2257	Secondary Air Injection System Control A Circuit Low • (BGN only)	○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to --> **Secondary Air Injection (AIR) Pump Relay J299 , Checking**.	Signal voltage, 3.0 V	• Pump relay - Commanded off • Engine speed ->80 RPM	0.5 Sec	• Contir • 2 DCY
P2258	Secondary Air Injection System Control A Circuit High • (BGN only)	○ Check the Secondary Air Injection (AIR) Pump Relay J299. Refer to -->	Signal current, 0.6-2.4 A	• Pump relay - Commanded off • Engine speed ->80	0.5 Sec	• Contir • 2 DCY

		Secondary Air Injection (AIR) Pump Relay J299 , Checking.		RPM		

Additional emission regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	○ Check Leak Detection Pump (LDP) V144. --> **Leak Detection Pump V144, Checking** ○ Check Evaporative Emission (EVAP) Canister System for proper seal --> **EVAP System, Checking for Leaks**.	Open circuit 4.5 5.5 V	• LDP Commanded On • Engine speed >80 RPM	0.5 Sec	• 2 DCY
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	○ Check Leak Detection Pump (LDP) V144. --> **Leak Detection Pump V144, Checking** ○ Check Evaporative	Short to ground 3.0 V	• LDP Commanded - Off • Engine speed >80 RPM • Battery voltage 9.0 16.05V	0.5 Sec	• 2 DCY

		Emission (EVAP) Canister System for proper seal --> **EVAP System, Checking for Leaks**.				
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	○ Check Leak Detection Pump (LDP) V144. --> **Leak Detection Pump V144, Checking** ○ Check Evaporative Emission (EVAP) Canister System for proper seal --> **EVAP System, Checking for Leaks**.	Short to battery+> 3.0 V	• LDP Commanded On • Engine speed >80 RPM	0.5 Sec	• 2 DCY
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	○ Check Leak Detection Pump (LDP) V144. --> **Leak Detection Pump V144, Checking** ○ Check Evaporative Emission (EVAP) Canister System for	Contact unable to close, Signal always low	• LDP Commanded - Off • Purge valve check Completed Ref. P0442	0.5 Sec	• 2 DCY

		proper seal --> **EVAP System, Checking for Leaks**.				
P2404	Evaporative Emission System Leak Detection Pump Sense Range/Performance	○ Check Leak Detection Pump (LDP) V144. --> **Leak Detection Pump V144, Checking** ○ Check Evaporative Emission (EVAP) Canister System for proper seal --> **EVAP System, Checking for Leaks**.	Contact unable to open Signal always high	• LDP Commanded - Off • Purge valve check Completed Ref. P0442	0.5 Sec	• 2 DCY
P2414	O2 Sensor Exhaust Sample Error (Bank 1 Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	Signal voltage, 3.7-4.8 V	• O2S ceramic temp. 750+/-65°C • If low fuel signal then wait >600 Sec. • SAI - not active	10 Sec	• Continuous • 2 DCY
P2415	O2 Sensor Exhaust Sample Error (Bank 2 Sensor 1) • (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated**	Signal voltage, 3.7-4.8 V	• O2S ceramic temp. 750+/-65°C • If low fuel signal then wait >600	10 Sec	• Continuous • 2 DCY

		Oxygen Sensor (HO2S) 2 G108 , checking.		Sec. - SAI - not active		
P2626	O2 Sensor Pumping Current Trim Circuit/Open (Bank 1 Sensor 1) - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) G39. Refer to **Heated Oxygen Sensor (HO2S) G39 , checking**.	O2S signal front, > 4.8 V	- O2S ceramic temp 750 +/- 65°C - Modeled exhaust gas temp - 700° C - Fuel cut off Active - If low fuel signal on, wait>600 Sec.	20 Sec	- Continuous - 2 DCY
P2629	O2 Sensor Pumping Current Trim Circuit/Open (Bank 2 Sensor 1) - (BGN only)	○ Check the Heated Oxygen Sensor (HO2S) 2 G108. Refer to **Heated Oxygen Sensor (HO2S) 2 G108 , checking**.	O2S signal front,> 4.8 V	- O2S ceramic temp 750 +/- 65°C - Modeled exhaust gas temp - 700° C - Fuel cut off Active - If low fuel signal on, wait>600 Sec.	20 Sec	- Continuous - 2 DCY

02E Transmission

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P2714	Pressure Control	○ Refer to	PWM hardware	- Low side and high	0.03 Sec	- Continuou

	Solenoid D Performance or Stuck off	• **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	detection, 0 or 100%	side FET, Activated • Power supply, > 9 V • Volage drop at FET, = 1 V • Solenoid supply, > 9 V		• 2 DCY
P2715	Pressure Control Solenoid D Stuck On	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 -**	PWM hardware detection, 0 or 100%	• Low side and high side FET, Activated • Power supply, > 9 V • Volage drop at FET, = 1	0.03 Sec	• Continuou • 2 DCY

		AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .		V • Solenoid supply, > 9 V		
P2716	Pressure Control Solenoid D Electrical	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL	Current higher or lower than threshold, (850-120) mA	• Low side and high side FET, Activated • Power supply, > 9 V • Volage drop at FET, = 1 V • Solenoid supply, > 9 V	0.03 Sec	• Continuou • 2 DCY

		COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .				
P2723	Pressure Control Solenoid E Performance or Stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	PWM hardware detection, 0 or 100%	• Low side and high side FET, Activated • Power supply, > 9 V • Volage drop at FET, = 1 V • Solenoid supply, > 9 V	0.05 Sec	• Continuou • 2 DCY
P2724	Pressure	○ Refer to	PWM	• Low side	0.05 Sec	• Continuou

	Control Solenoid E Stuck On	• **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING • **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .	hardware detection, 0 or 100%	and high side FET, Activated • Power supply, > 9 V • Volage drop at FET, = 1 V • Solenoid supply, > 9 V		• 2 DCY
P2732	Pressure Control Solenoid F Performance or Stuck off	○ Refer to • **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V • **38 -**	PWM hardware detection, 0 or 100%	• Low side and high side FET, Activated • Power supply, > 9 V • Volage drop at FET, = 1	0.05 Sec	• Continuou • 2 DCY

		AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .		V - Solenoid supply, > 9 V		
P2733	Pressure Control Solenoid F Stuck On	○ Refer to - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V - **38 - AUTOMATIC TRANSMISSION - GEARS, HYDRAULIC CONTROLS** for 5 SPD. AUTOMATIC TRANSMISSION 01V FRONT AND ALL WHEEL DRIVE - INTERNAL	PWM hardware detection, 0 or 100%	- Low side and high side FET, Activated - Power supply, > 9 V - Volage drop at FET, = 1 V - Solenoid supply, > 9 V	0.05 Sec	- Continuou - 2 DCY

		COMPONENTS, SERVICING - **38 GEARS, CONTROL** for 6 SPD. AUTOMATIC TRANSMISSION 09L ALL WHEEL DRIVE .				

SAE P3xxx Diagnostic Trouble Codes

Fuel and air mixture, additional emissions regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P3081	Engine Temperature Too Low - (BGN only)	○ Check the Engine Coolant Temperature (ECT) Sensor G62. Refer to --> **Engine Coolant Temperature (ECT) Sensor G62 , Checking**.	- Measured ECT minus ECT, >9.75K	---	2 Sec	- Once/DCY - 2 DCY
P3262	Exhaust bank 1/2 oxygen sensors behind catalytic converter swapped		- Threshold high side > 680 mV - Threshold low side 221 mV	- Lambda controller Closed loop - Rear O2 sensor heater and electrical check No fault - Engine speed 1000 - 4000	30 Sec	2 DCY

				RPM • Engine load 20-50% • Catalyst temperature > 345°C		

SAE U0xxx Diagnostic Trouble Codes

Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
U0001	High Speed CAN Communication Bus • (BGN only)	○ Check terminal resistance of CAN-Bus --> **CAN-Bus Terminal Resistance, Checking**.	• CAN message no feedback	---	2 Sec	• Continuous • 2 DCY
U0101	Lost Communication with TCM • (BGN only)	○ Check terminal resistance of CAN-Bus --> **CAN-Bus Terminal Resistance, Checking**.	• CAN message no feedback	---	2 Sec	• Continuous • 2 DCY
U0302	Software Incompatibility with Transmission Control Module • (BGN only)	○ Check terminal resistance of CAN-Bus --> **CAN-Bus Terminal Resistance, Checking**.	AT vehicle ECM coded as MT vehicle	---	2 Sec	• Continuous • 2 DCY

20 - FUEL SUPPLY

FUEL SUPPLY SYSTEM

Fuel Supply System

The following table provides quick links to all chapters in this section.

--> **Safety Precautions**
--> **Clean Working Conditions**
--> **Transfer Fuel Pump (FP) G6 Electrical, Checking**
--> **Fuel Delivery, Checking**

For all fuel supply system component locations. Refer to **20 - FUEL SUPPLY SYSTEM** .

For all fuel supply system removal/installation procedures and torque specifications. Refer to **20 - FUEL SUPPLY SYSTEM** .

Check the Technical Bulletins for information that may supersede any information included in this article.

NOTE:

- **All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through Audi.**
- **Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.**
- **The manufacturers test box Test Box 105 Pin VAG1598/31 is available for purchase or rental.**

CAUTION: The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or damage to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

--> **Safety Precautions**

--> **Clean Working Conditions**

--> **Transfer Fuel Pump (FP) G6 Electrical, Checking**

--> Fuel Delivery, Checking

Safety Precautions

CAUTION:

- **Fuel system is under pressure! Before opening system, place rags around the connection area. Then release pressure by carefully loosening the connection.**
- **Vehicles with FSI engine: The engine section of the fuel system, after the high pressure pump, is under extremely high pressure! When working on engine or fuel injection system, pressure must be relieved to residual pressure before opening high pressure components. Refer to 24 MULTIPORT FUEL INJECTION (MFI) .**

Perform the following steps before beginning work on the Fuel system:

- Disconnect the battery Ground (GND) cable with the ignition switched off.
- Open the fuel filler flap briefly and then close again.

When removing and installing components from full or partially full fuel tanks, observe the following:

- The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.
- Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m^3/h can be used.
- Prevent fuel from contacting the skin! Wear fuel-resistant gloves!

Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to the following rules of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place parts that have been removed on a clean surface and cover them. Do not use fluffy cloths!
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).

- When the system is open: Do not work with compressed air. Do not move vehicle unless absolutely necessary.

Transfer Fuel Pump (FP) G6 Electrical, Checking

Special tools, testers and auxiliary items required

- Hand held remote control (jumper).
- Multimeter.
- Electrical connector test lead set.

Test conditions

- Battery voltage 12.5 V.
- Fuse S228 OK.
- Fuse S132 OK.
- Fuse S134 OK.

- Fuel Pump (FP) Relay J17 OK.
- Fuel filter OK.
- Ignition switched off.

Test procedure

- ○ Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**

Start diagnosis

TT Coupe

- ○ Remove the rear seat bench. Refer to -->
  - **72 - SEAT - FRAMES**
  - **72 - SEAT - FRAMES** for BODY INTERIOR - CABRIOLET

.

TT Roadster

- ○ Remove the right rear side trim panel. Refer to -->
  - **70 - INTERIOR TRIM**
  - **70 - INTERIOR TRIM** for BODY INTERIOR - CABRIOLET

.

All vehicles

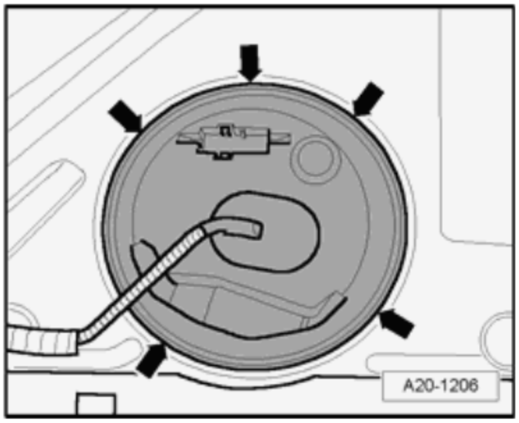

Fig. 1: Identifying Right Sealing Flange & Cover Retainers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the cover retainers - **arrows** - from the right sealing flange.

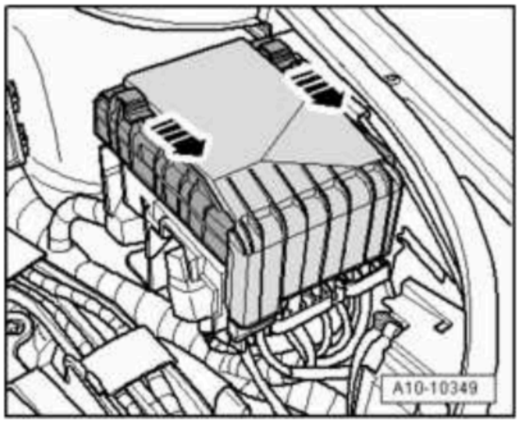

Fig. 2: Removing Engine Compartment E-Box Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press both latches in direction of - **arrow** - and remove the engine compartment E-box cover.

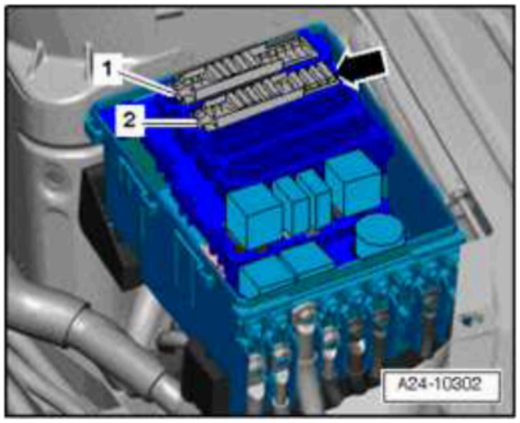

Fig. 3: Removing Fuse SB1 From "Fuse Carrier ST2"
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove Fuse SB1 from "fuse carrier ST2" - **2** -.

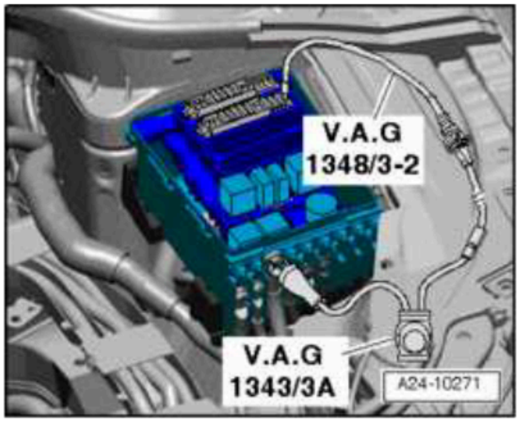

Fig. 4: Connecting Hand Held Remote Control (Jumper) To Terminal On Fuse SB1 And To Battery "+"
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect a Hand held remote control (jumper) to the terminal on Fuse SB1 and to battery "+".
- Press the switch on the Hand held remote control (jumper).

NOTE:

- **The Fuel Pump (FP) runs quietly. Avoid surrounding noises while testing the fuel pump.**

- Listen for an operating noise from the Transfer Fuel Pump (FP) G6.

If no operating noise is heard:

- Remove the fuel delivery unit. Refer to --> **20 - FUEL SUPPLY SYSTEM** .

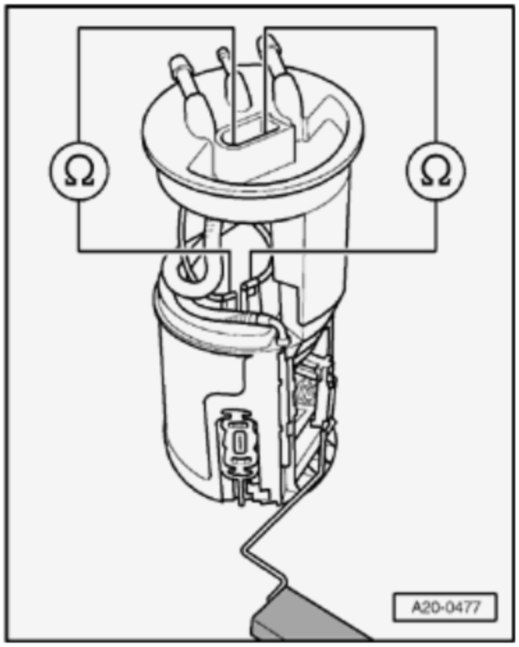

Fig. 5: Checking Electrical Circuit Between Terminals Of Fuel Delivery Unit And Fuel Pump For Continuity
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Transfer Fuel Pump (FP) G6 electrical connector terminals 1 to 4 for continuity.

Specified value: 0 ohms.

If the specification was not obtained:

- Check the Transfer Fuel Pump (FP) G6 electrical harness connector terminal 1 to 4 for a short circuit to Battery positive (+) or an open circuit.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and the resistance value was not OK:

- Replace the Transfer Fuel Pump (FP) G6. Refer to **20 - FUEL SUPPLY SYSTEM** .

If no malfunction is detected in the wiring and the resistance value was OK:

If an operating noise is heard:

Checking voltage

- Switch the ignition on.
- Using a Multimeter , check the Transfer Fuel Pump (FP) G6 electrical harness connector terminal 1 to Ground (GND) for voltage.

- Switch the ignition off.

Specified value: Battery voltage.

If the specification was not obtained:

- Check the Transfer Fuel Pump (FP) G6 electrical harness connector terminal 1 to the Fuel Pump (FP) Relay J17 socket 23/87 for an open circuit, or a short circuit to Battery positive (+) or Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specification was obtained:

Checking Ground (GND)

- Using a Multimeter , check the Transfer Fuel Pump (FP) G6 electrical harness connector terminal 5 to the Ground (GND) connection on right lower A-pillar for resistance.

Specified value: 1.5 ohms Max.

If the specification was not obtained:

- Check the Transfer Fuel Pump (FP) G6 electrical harness connector terminal 4 to the Ground (GND) connection on right lower A-pillar for an open circuit, or a short circuit to Battery positive (+) or Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Replace the Fuel Pump (FP) Relay J17.
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code Description**.

End of diagnosis

Fuel Delivery, Checking

Special tools, testers and auxiliary items required

- Hand held remote control (jumper).
- Multimeter.
- Electrical connector test lead set.
- Measuring container, fuel-resistant.

Test conditions

- Battery voltage 12.5 V
- Fuel filter OK
- Fuel tank at least $^1/_4$ filled.
- Fuel pressure regulator OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**

Start diagnosis

- Open cover from fuse box at left side of instrument cluster.
- Remove fuse 28 at fuse holder.
- Connect remote control connection at right terminal of socket of fuse S28.
- Connect alligator clip to vehicle battery B+.
- Remove the fuel filler cap from fuel filler.

CAUTION: Fuel system is under pressure! Before opening the system, place rags around the connection area. Then release the pressure by carefully loosening the connection.

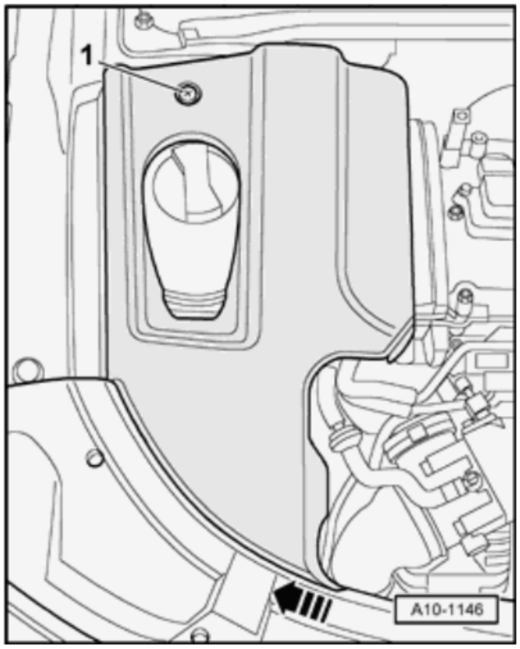

Fig. 6: Removing Screw And Coolant Expansion Tank Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove the bolt - **1** - and the cover above reservoir - **arrow** -.

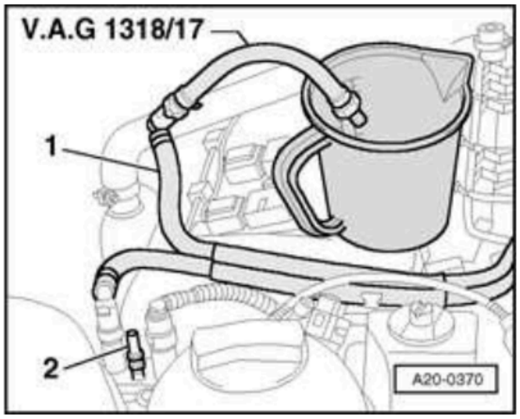

Fig. 7: Disconnecting Fuel Return Line From Line Tube & Connecting VAG1318/17 Adapter To Fuel Return Line From Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the fuel return line - **1** - from the line connection - **2** - by pressing the release button.
- Connect the Fuel pressure test set (high pressure) onto the disconnected fuel return line.
- Press switch on remote control for 15 Sec.

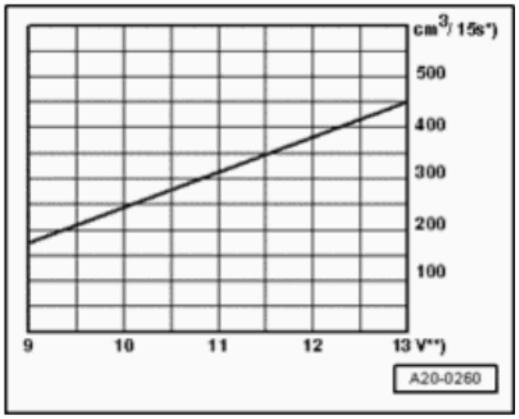

Fig. 8: Delivery Rate Diagram
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compare quantity of fuel delivered with minimum delivery rate in the diagram (cm ^{3} /15s).

NOTE:

- **Voltage at the fuel pump with engine stopped and fuel pump running is approx. 2 volts less than battery voltage.**

If minimum delivery quantity is not obtained, the following malfunctions may be present:

- Fuel lines pinched.
- Fuel filter clogged.
- Fuel pump faulty.

Assembly is performed in reverse order of removal.

End of procedure

EVAP SYSTEM

EVAP System

The following table provides quick links to all chapters in this section.

--> **EVAP System, Detecting Leaks**
--> **EVAP System, Checking for Leaks**
--> **EVAP Canister Purge Regulator Valve N80, Checking**
--> **Leak Detection Pump V144, Checking**

For all EVAP system component locations and hose routing. Refer to --> **20 - FUEL SUPPLY SYSTEM** .

For the EVAP system hose routing. Refer to **20 - FUEL SUPPLY SYSTEM** .

For all EVAP system removal/installation procedures and torque specifications. Refer to **20 - FUEL SUPPLY SYSTEM** .

Check the Technical Bulletins for information that may supersede any information included in this article.

NOTE:

- **All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through Audi.**
- **Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.**

--> **EVAP System, Detecting Leaks**

--> **EVAP System, Checking for Leaks**

--> **EVAP Canister Purge Regulator Valve N80, Checking**

--> **Leak Detection Pump V144, Checking**

EVAP System, Detecting Leaks

Function

The leak detection system recognizes leaks in the complete fuel system, including the fuel tank, EVAP canister and the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.

On the mechanical side, the leak detection system consists mainly of a vacuum-driven diaphragm pump equipped with a reed contact on the actuation rod of the pump diaphragm. The pump is supplied with vacuum by the engine intake stroke.

- When leak detection is activated, the diaphragm pump pumps the fuel system up to 20 30 mbar. The pump diaphragm is then moved out so that the reed contact at the operating rod remains in the "open" position.
- During the leak diagnosis, the reed contact is monitored to check if it remains open within 10 Sec. This indicates the system is sealed.
- If the pressure falls (indicating a leak), the diaphragm moves back and the reed contact closes.
- If the reed contact closes within 10 Sec of leak detection time, a further test is performed: In this case the diaphragm pump pumps four times again. The Motronic Engine Control Module (ECM) J220 measures the time for each of the four pumps until the reed contact is closed again. From that, the control module can recognize a "small leak" (greater than 1 mm in diameter) or a "large leak".

Leak diagnosis is activated automatically shortly following every engine start. If a malfunction is determined, an entry is made to the Diagnostic Trouble Code (DTC) memory. The Malfunction Indicator Lamp (MIL) K83 in the instrument cluster lights up if the malfunction is recognized for two subsequent starts.

EVAP System, Checking for Leaks

Special tools, testers and auxiliary items required

- Smoke tester.
- EVAP and Fuel Supply System Vacuum hose and line routing diagram.

NOTE:

- **Secure all hose connections using hose clamps appropriate for the model type**
- **Replace seals and gaskets when performing repair work.**

Leak checking

- Using a Smoke tester , check the Evaporative Emission (EVAP) canister system for leaks.

NOTE:

- **Always follow the manufacturers directions for the proper installation and operation of the Smoke tester being used.**

If a leak is detected:

- Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.
- Check the seals under the locking flanges and the union nuts are properly tightened on the fuel tank.
- Check all hose connections of the fuel supply system and replace or repair any leaking lines.
- Check all hose connections of the EVAP system and replace or repair any leaking lines.

- Repair or replace any damaged component.

If no leaks are found in the EVAP and Fuel Supply System:

- Erase the DTC memory if a DTC was set. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to verify repair.

If a DTC was set and does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code Description**.

- End diagnosis.

If the DTC does return and no leaks are found in the EVAP and Fuel Supply System:

- Check the DTC memory for any DTC codes pertaining to the EVAP and Fuel Supply Systems. If a DTC is stored, perform the diagnostic test procedure for the suspected component. Refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory**.

End diagnosis.

If the DTC does return and no leaks are found in the EVAP and Fuel Supply System:

- Check the DTC memory for any DTC codes pertaining to the EVAP and Fuel Supply Systems. If a DTC is stored, perform the diagnostic test procedure for the suspected component. Refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory**.

End diagnosis.

EVAP Canister Purge Regulator Valve N80, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuse S234 OK.
- Fuel Pump (FP) Relay J17 OK.
- The ignition switched off.

NOTE:

- **Voltage for the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 is supplied by the Fuel Pump (FP) Relay J17.**

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

Start diagnosis

- Disconnect the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 electrical harness connector.

Checking internal resistance

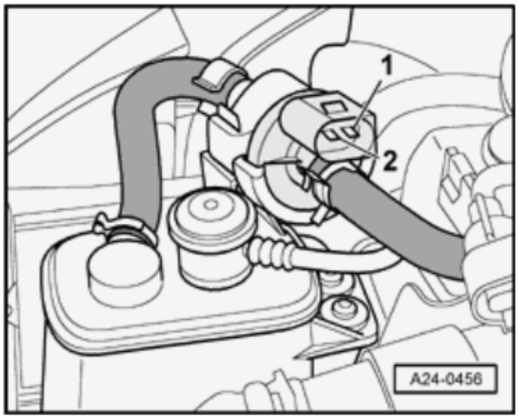

Fig. 9: Identifying Terminals 1 And 2 Of Evaporative Emission (EVAP) Canister Purge Regulator Valve N80
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the resistance between terminals 1 and 2 of the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.

Specified value: 22.0 to 30.0 ohms.

If the specified value was not obtained:

- Replace the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80.

If the specification is obtained:

Checking voltage supply

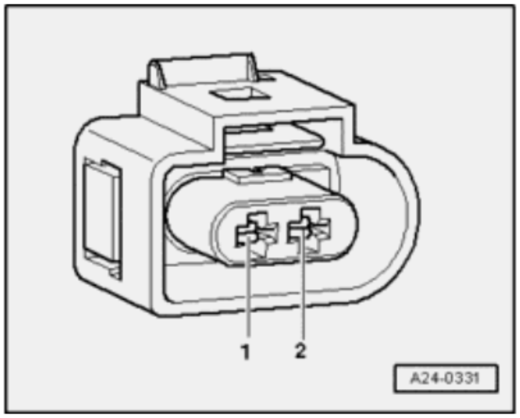

Fig. 10: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the electrical harness connector terminal 1 to Ground (GND) for voltage.

Evaporative Emission (EVAP) Canister Purge	**Measure to**

Regulator Valve N80 Electrical Harness connector Terminal	
1	Engine Ground (GND)

- Operate the starter briefly.

Specified value: battery voltage.

If the specified value was not obtained:

- Check the wiring connection from the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 electrical harness connector terminal 1 to the Fuel Pump (FP) Relay J17 terminal 19/86 for an open circuit or a short circuit to Battery positive (+).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If the specified value was obtained:

Checking wiring

If the manufacturers test box is being used, perform the following step.

- Install the test box VAG1598/31. Refer to **24 MULTIPORT FUEL INJECTION (MFI)** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.

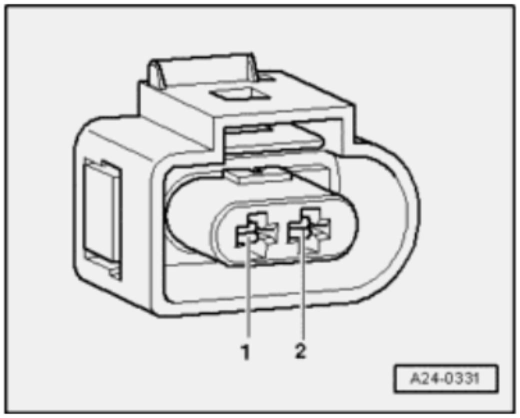

Fig. 11: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 electrical connector terminal 2 to the Motronic Engine Control Module (ECM) J220 electrical harness connector terminal 64 for resistance.

Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 Electrical harness connector terminal	Motronic Engine Control Module (ECM) J220 electrical harness connector terminal test box socket
2	64

Specified value: 1.5 ohms.

If the specification was not obtained:

- Check the wiring for a short circuit to Battery positive (+), Ground (GND) or an open circuit.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If the specification was obtained:

- Erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code Description**.

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.
- Assembly is performed in the reverse of the removal.

Final procedures

After repair work, the following work steps must be performed in the mentioned sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code Description**.

End of diagnosis

Leak Detection Pump V144, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuse S234 OK.
- The Fuel Pump (FP) Relay J17 OK.
- The ignition switched off.

Test procedure

- ○ Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.
- ○ Remove the left rear wheel housing liner. Refer to
  - **66 EXTERIOR EQUIPMENT**
  - **66 - EXTERIOR EQUIPMENT** for BODY EXTERIOR - CABRIOLET

.

Start diagnosis

- ○ Remove the right front wheel.
- ○ Remove the right front wheel housing liner.

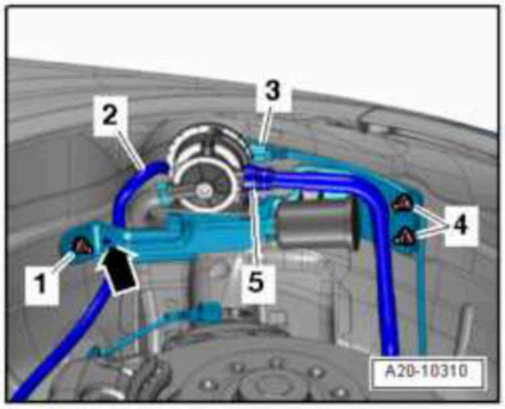

Fig. 12: Disconnecting Leak Detection Pump (LDP) V144 Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- ○ Disconnect the Leak Detection Pump (LDP) V144 electrical harness connector - **3** -.

Checking internal resistance

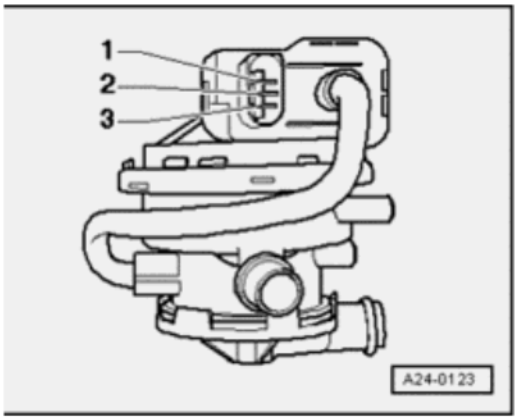

Fig. 13: Locating 3-Pin Connector At Fuel System Leak Detection Pump V144
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Leak Detection Pump (LDP) V144 for resistance as follows:

Leak Detection Pump (LDP) V144 electrical harness connector terminals	Specified values
- **1** - + - **3** -	640 to 720 ohms
- **2** - + - **3** -	15 to 17 ohms

If any of the specifications are not obtained:

- Replace the Leak Detection Pump (LDP) -V144-. Refer to **20 - FUEL SUPPLY SYSTEM** .

If the specified values are obtained:

Checking voltage supply

NOTE:

- **The voltage for the Leak Detection Pump (LDP) -V144- is supplied by the Fuel Pump (FP) Relay J17.**

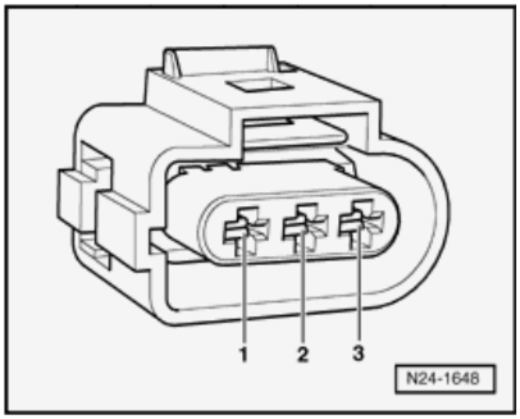

Fig. 14: Identifying 3-Pin Electrical Connector & Terminals

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Leak Detection Pump (LDP) -V144- electrical harness connector terminal 3 for voltage.

Leak Detection Pump (LDP) -V144- electrical harness connector terminal	Measure to
- **3** -	Engine Ground (GND)

- Operate the starter briefly.

Specified value: battery voltage.

- Switch the ignition off.

If the specified value was not obtained:

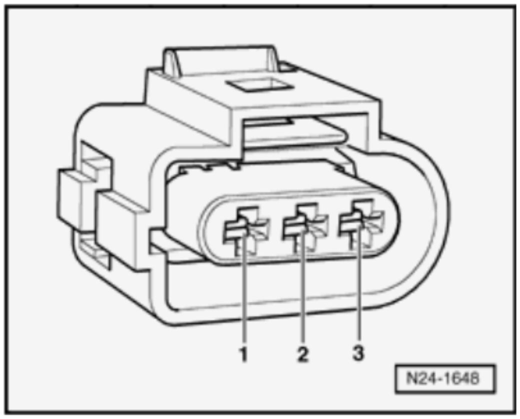

Fig. 15: Identifying 3-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Leak Detection Pump (LDP) -V144- electrical harness connector terminal 3 to the Fuel Pump (FP) Relay J17 socket 2 for resistance.

Specified value: 1.5 ohms max

If the specification was not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and if the voltage supply was OK:

Checking wiring

If the manufacturers test box is being used, perform the following step.

- Install the test box VAG1598/31. Refer to **24 MULTIPORT FUEL INJECTION (MFI)** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.
- Using a Multimeter , check the Leak Detection Pump (LDP) -V144- electrical harness connector terminal 1 to Motronic Engine Control Module (ECM) J220 electrical harness connector terminal 80 for resistance.

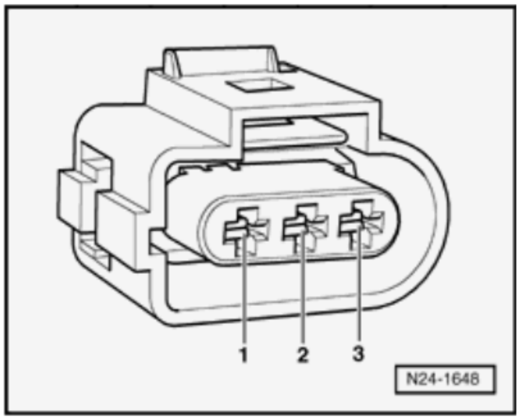

Fig. 16: Identifying 3-Pin Electrical Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Leak Detection Pump (LDP) -V144- electrical harness connector terminal 2 to Motronic Engine Control Module (ECM) J220 electrical harness connector terminal 25 for resistance.

Leak Detection Pump (LDP) -V144- electrical harness connector terminals	Motronic Engine Control Module (ECM) J220 electrical connector terminals or test box sockets
1	80
2	25

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+), Ground (GND) or an open circuit.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in wiring:

- Erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code Description**.

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code Description**.

End of diagnosis

ELECTRONIC ENGINE POWER CONTROL

Electronic Engine Power Control

The following table provides quick links to all chapters in this section.

--> **Electronic Power Control System**
--> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**

--> **Electronic Power Control System**

--> **Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking**

Electronic Power Control System

For "EPC" , the throttle valve is not operated by a cable from the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to Motronic Engine Control Module (ECM) J220 by Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 (variable resistances; stored in one housing) that are connected with the accelerator pedal.

The accelerator pedal position (drivers intention) is a main input unit for the Motronic Engine Control Module (ECM) J220.

Operation of the throttle valve occurs by an electric motor in the Throttle Valve Control Module J338. This is true across the entire engine speed and engine load spectrum.

Throttle valve is operated by Accelerator Pedal Position Sensor 2 G185 according to specifications of Motronic Engine Control Module (ECM) J220.

With engine off and ignition switched on, Motronic Engine Control Module (ECM) J220 controls the Throttle Valve Control Module J338 exactly according to specifications of Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185. This means, if the accelerator pedal is depressed half way, the Accelerator Pedal Position Sensor 2 G185 opens the throttle valve to the same degree; i.e. throttle valve is then opened approx. half way.

With engine running (under load), Motronic Engine Control Module (ECM) J220 can open or close the throttle valve independently of Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185.

This means, for example, that the throttle valve could be fully opened even though the accelerator pedal has only been depressed half way. This has the advantage of preventing torque losses at the throttle valve.

In addition to this, it results in significantly better values relative to emissions and consumption under certain load conditions.

It would be incorrect to think that "EPC" consists of only one or two components. "EPC" is much more of a system containing all components that contribute to recognizing, controlling and monitoring the position of the throttle valve.

- Observe Safety Precautions.
- Observe Clean Working Conditions.

Throttle Position Sensor G79 and Accelerator Pedal Position Sensor 2 G185, Checking

Special tools, testers and auxiliary items required

- Multimeter.
- Wiring diagram

Test requirement

- The Motronic Engine Control Module (ECM) J220 fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".

- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.

NOTE:

- **Sensors are contained within one housing.**
- **Use only gold-plated terminals when servicing the electrical harness connector terminals in Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185.**

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to --> **Preliminary Check**.

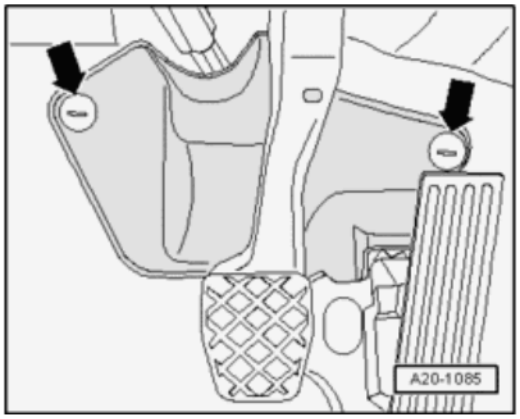

Fig. 17: Removing Steering Column Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release the tabs - **arrows** - and remove the steering column cover.

Start diagnosis

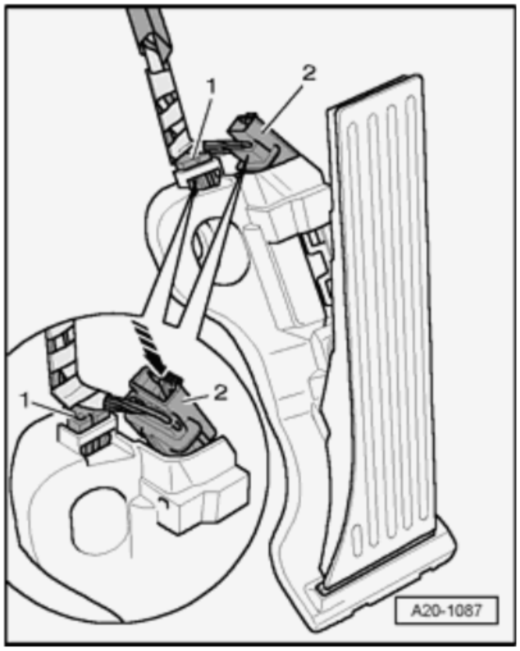

Fig. 18: Identifying Throttle Position Sensor G9/Throttle Position Sensor G88 6-Pin Electrical Harness Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect the Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 electrical harness connector - **2** -.

Checking voltage supply and wiring

- Switch the ignition on.

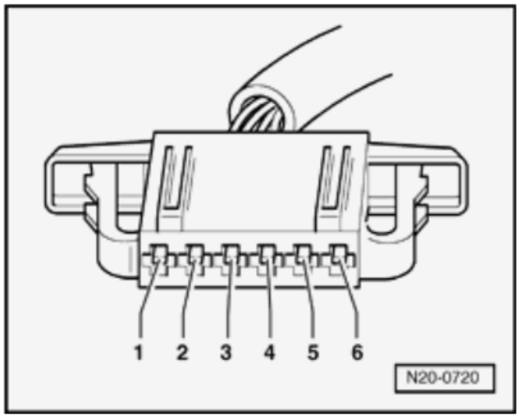

Fig. 19: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the following wiring connections for voltage.

Throttle Position (TP) Sensor G79/Accelerator	Specified value

Pedal Position Sensor 2 G185 electrical harness connector terminal	
1 to Ground (GND)	about 5 V
1 to 5	about 5 V
2 to Ground (GND)	about 5 V
2 to 3	about 5 V

- Switch the ignition off.

If the specification is not obtained:

If the manufacturers test box is being used, perform the following step.

- Install the test box VAG1598/31. Refer to **24 MULTIPORT FUEL INJECTION (MFI)** .

If the manufacturers test box is not being used, perform the following step.

- Remove the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.

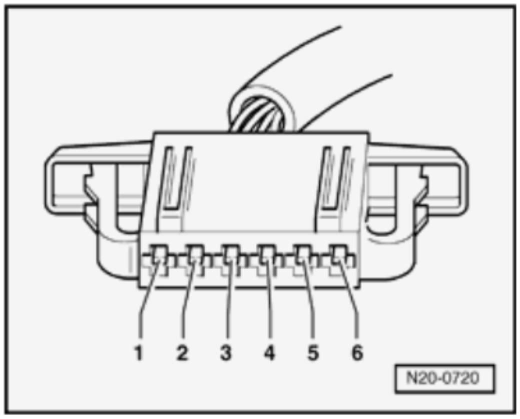

Fig. 20: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a Multimeter , check the Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 electrical harness connector terminals to the Motronic Engine Control Module (ECM) J220 electrical connector for resistance.

Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 electrical harness connector terminals	Motronic Engine Control Module (ECM) J220 electrical harness connector terminals or test box socket
1	72
2	73
3	36

4	35
5	33
6	34

Specified value: 1.5 ohms max.

If the specification is not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185. sensors are contained within one housing.

If no malfunction is detected in the wiring and if the voltage supply was not OK:

- Erase the DTC memory. Refer to --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to --> **Readiness Code Description**.

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Motronic Engine Control Module (ECM) J220. Refer to --> **Motronic Engine Control Module (ECM) J220 , Replacing**.
- Assembly is performed in the reverse of the removal.

Final procedures

After repair work, the following work steps must be performed in the following sequence:

1. Check the DTC memory.
2. If necessary, erase the DTC memory. Refer to **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
3. If the DTC memory was erased, generate readiness code. Refer to **Readiness Code Description**.

End of diagnosis

, Component locations. , Removal and Installation procedures.

24 MULTIPORT FUEL INJECTION (MFI)

MOTRONIC INJECTION SYSTEM, SERVICING

Safety precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

WARNING: **The fuel system is under pressure. Place a cloth around the connection point before opening the system. Then relieve pressure carefully loosening the connection.**

- Always switch off ignition before disconnecting or connecting lines of the fuel injection and ignition system, including test leads.
- If engine is to be cranked at starting RPM without starting (e.g. for compression testing), disconnect connector from ignition coils and from fuel injectors.
- During some of the tests, a malfunction may be recognized and stored by the control module. At the end of all tests and repairs, the Diagnostic Trouble Code (DTC) memory should be checked and, if necessary, erased. After erasing the Diagnostic Trouble Code (DTC) memory the readiness code must be produced. Refer to **Basic setting**.
- Always switch ignition off before cleaning engine.

WARNING:

- **Safety precautions before disconnecting battery:**

Refer to

- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL for ELECTRICAL EQUIPMENT, CABRIOLET**

- **Always switch ignition off before disconnecting or connecting battery. Failure to do so may damage a control module.**

If special testing equipment is required during road test, note the following:

WARNING:

- **Test equipment must always be secured to the rear seat and operated from there by a second person.**
- **If test and measuring equipment is operated from the passenger seat, the person seated there could be injured in the event of an accident involving deployment of the passenger-side airbag.**

Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following 6 cleanliness rules:

- Thoroughly clean all unions and adjacent areas before disconnecting.
- Place removed parts on a clean surface and cover. Use lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Install clean components: Remove replacement parts from packaging immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc..).

- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- Separated electrical connectors: Protect from dirt and moisture. Make sure connections are dry when re-connecting.

Technical data

Engine codes		**AVK (3.0 L/5V/162 kW-engine)**	**BGN (3.0 L/5V/162 kW-engine)**
Idle speed Engine speed cannot be adjusted, it is regulated by idle stabilization		700 to 800 RPM1)	700 to 800 RPM1)
Engine speed (RPM) limitation via fuel injector shut-off		approx. 6800 RPM	approx. 6800 RPM
Fuel pressure at idle speed	Vacuum hose connected	3.2 to 3.8 bar positive pressure	---
	Vacuum hose Disconnected	3.8 to 4.2 bar positive pressure	---
		---	3.8 to 4.2 bar positive pressure
Residual pressure after 10 min.	Cold engine	approx. 2.2 bar positive pressure	approx. 2.2 bar positive pressure
	Warm engine	approx. 3.0 bar positive pressure	approx. 3.0 bar positive pressure
Fuel injectors	Injection stream	Two-hole nozzle/same for all injectors	Two-hole nozzle/same for all injectors
	Injection quantity (30 s)	90 to 125 ml	90 to 125 ml
	Resistance (room temperature)	11 to 13 ohms	11 to 13 ohms

1) Depending on engine oil temperature/transmission oil temperature (automatic transmission 01J) an engine speed increase is possible up to 980 RPM.

Component locations, overview

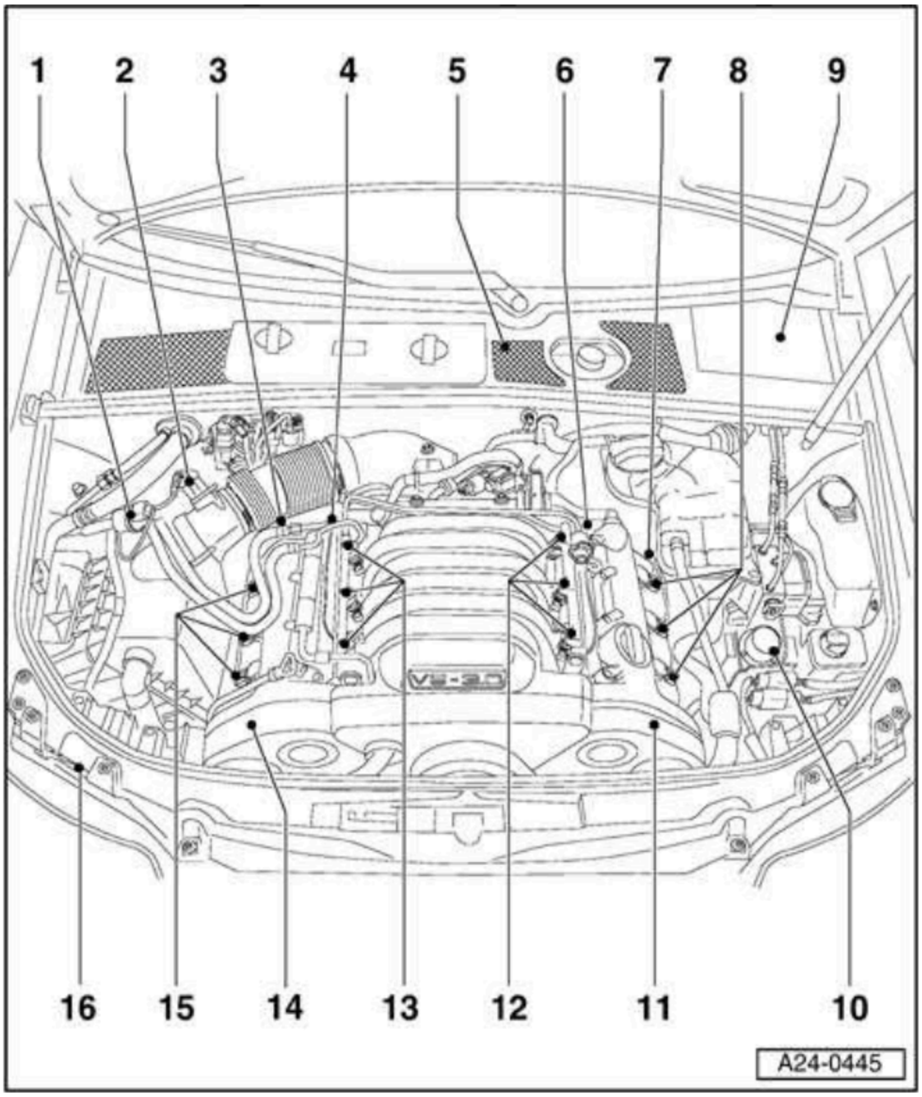

Fig. 95: Motronic Injection System Component Locations, Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Evaporative Emission (EVAP) canister purge regulator valve -N80-

- Checking. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking**

2 - Mass Air Flow (MAF) sensor -G70-

- With intake air temperature (IAT) sensor -G42-
- Checking. Refer to **Mass Air Flow (MAF) sensor -G70-, checking**

3 - Camshaft Position (CMP) sensor 3 -G300-

- For exhaust camshaft
- Cylinder bank 1
- Checking. Refer to **Camshaft Position (CMP) sensor, checking**

4 - Camshaft Position (CMP) sensor -G40-

- For intake camshaft
- Cylinder bank 1
- Checking. Refer to **Camshaft Position (CMP) sensor, checking**

5 - Pressure sensor for brake booster pressure sensor -G294-

- For vehicles with automatic transmission
- Location. See **Fig. 104**

6 - Camshaft Position (CMP) sensor -G163-

- For intake camshaft
- Cylinder bank 2
- Checking. Refer to **Camshaft Position (CMP) sensor, checking**

7 - Camshaft Position (CMP) sensor 4 -G301-

- For exhaust camshaft
- Cylinder bank 2
- Checking. Refer to **Camshaft Position (CMP) sensor, checking**

8 - Ignition coils with power output stage, bank 2

- Ignition Coil 4 with Power Output Stage -N292-
- Ignition Coil 5 with Power Output Stage -N323-
- Ignition Coil 6 with Power Output Stage -N324-
- Checking. Refer to **Ignition coils with output stages, checking**

9 - Electronics box (plenum chamber)

- Locations. See **Fig. 99** and **Fig. 100**
- Location for Motronic Engine Control Module (ECM) -J220-
- Check power supply to engine control module. Refer to **Engine Control Module (ECM) power supply, checking**.
- Procedure following interruption of voltage supply. Refer to **Procedure following interruption of voltage supply**

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**
- Location for Motronic Engine Control module (ECM) power supply relay -J271-
- Test for Motronic Engine Control Module (ECM) power supply relay -J271-. Refer to **Motronic Engine Control Module (ECM) power supply relay -J271-, checking**
- Location for Secondary Air Injection (AIR) pump relay -J299-.

- Check Secondary Air Injection (AIR) pump relay -J299-:

Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**

- Location for fuse S130 for secondary air pump
- Location for Brake booster relay -J569-

10 - Brake system vacuum pump -V192-

- For vehicles with automatic transmission

11 - Valve 2 for camshaft adjustment -N208-, Camshaft adjustment valve 2 (exhaust) -N319-

- Cylinder bank 2
- Checking:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

12 - Fuel injectors, bank 2

- Cylinder 4 Fuel Injector -N33-
- Cylinder 5 Fuel Injector -N83-
- Cylinder 6 Fuel Injector -N84-
- Checking. Refer to **Fuel injectors, checking**

- Removing and installing. Refer to **Fuel injectors, removing and installing**.

13 - Fuel injectors, bank 1

- Cylinder 1 Fuel Injector -N30-
- Cylinder 2 Fuel Injector -N31-
- Cylinder 3 Fuel Injector -N32-
- Checking. Refer to **Fuel injectors, checking**

- Removing and installing. Refer to **Fuel injectors, removing and installing**.

14 - Valve 1 for camshaft adjustment -N205- Camshaft adjustment valve 1 (exhaust) -N318-

- Cylinder bank 1
- Checking:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

15 - Ignition coils with power output stage, bank 1

- Ignition Coil 1 with Power Output Stage -N70-
- Ignition Coil 2 with Power Output Stage -N127-
- Ignition Coil 3 with Power Output Stage -N291-
- Checking. Refer to **Ignition coils with output stages, checking**

16 - Secondary Air Injection (AIR) pump motor -V101-

- Checking:

Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

17 - Heated Oxygen Sensor (HO2S) -G39- and Oxygen sensor (O2S) heater -Z19-

- Bank 1, sensor 1
- Constant Heated Oxygen Sensor (HO2S)
- Check oxygen sensors and oxygen sensor control before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**
- Check aging of oxygen sensors before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking aging**
- Check heating of oxygen sensors before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
- Removing and installing. Refer to **Oxygen sensors before catalytic converter, removing and installing**.

18 - Bracket for connectors

- For right side of vehicle
- Assignment. See **Fig. 101**

19 - Oxygen sensor (O2S) behind three way catalytic converter (TWC) -G130- and Oxygen Sensor (O2S) heater 1 -Z29-

- Bank 1, sensor 2
- Check oxygen sensors and oxygen sensor control behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking**
- Check heating of oxygen sensors behind catalytic converter. Refer to **Oxygen sensors behind catalytic**

converter, checking heating

- Removing and installing. Refer to **Oxygen sensors behind catalytic converter, removing and installing**.

20 - Engine Coolant Temperature (ECT) sensor -G62-

- For engine control module
- On coolant line behind cylinder head, bank 1
- With Engine Coolant Temperature (ECT) sensor -G2-
- Checking. Refer to **Engine Coolant Temperature (ECT) sensor -G62-, checking**

- If necessary, release cooling system pressure before removal

21 - Throttle valve control module -J338-

- With Throttle drive (power accelerator actuation) -G186-, Angle sensor -1- for throttle drive (power accelerator actuation) -G187- and Angle sensor -2- for throttle drive (power accelerator actuation) -G188-
- Checking. Refer to **Throttle valve control module -J338-, checking**
- Perform adaptation on replacing. Refer to **Throttle valve control module -J338-, adaptation**

22 - Secondary Air Injection (AIR) solenoid valve -N112-

- Checking:

Refer to **26 EXHAUST SYSTEM, EMISSION CONTROLS**

23 - Engine speed (RPM) sensor -G28-

- In gear case above ring gear
- Checking. Refer to **Engine speed (RPM) sensor -G28-, checking**

24 - Bracket for connectors

- For left side of vehicle
- Assignment. See **Fig. 102**

25 - Throttle Position (TP) sensor -G79- and Sender -2- for accelerator pedal position -G185-

- Location. See **Fig. 96**
- Checking. Refer to **Accelerator position sensor, checking**
- Adapting kick down function. Refer to **Kickdown function, adapting**

26 - Fuel Pump (FP) relay -J17-

- Location. See **Fig. 97**
- Checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**

27 - Brake light switch -F- and Brake pedal switch (cruise control/diesel direct fuel injection -F47-

- Location. See **Fig. 98**
- Checking. Refer to **Brake light switch and brake pedal switch, checking**

28 - Clutch vacuum vent valve switch -F36-

- Location. See **Fig. 98**
- Checking. Refer to **Clutch pedal switch check -F36-, checking**

29 - Instrument cluster:

- With exhaust Malfunction Indicator Lamp (MIL) -K83-. Notes on warning lamp. Refer to **Exhaust Malfunction Indicator Lamp (MIL) in instrument cluster**
- With Electronic Power Control (EPC) Warning Lamp -K132-. (check) Notes on EPC warning lamp. Refer to **Malfunction lamp for electronic throttle in instrument cluster**.

30 - Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131- and Oxygen Sensor (O2S) heater 2 -Z30-

- Bank 2, sensor 2
- Check aging of oxygen sensors behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking aging**
- Check heating of oxygen sensors behind catalytic converter. Refer to **Oxygen sensors behind catalytic converter, checking heating**
- Removing and installing. Refer to .

31 - Heated oxygen sensor (HO2S) 2 -G108- and Oxygen Sensor (O2S) 2 heater -Z28-

- Bank 2, sensor 1
- Constant heated oxygen sensor (HO2S)
- Check oxygen sensors and oxygen sensor control before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**
- Check aging of oxygen sensors before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking aging**
- Check heating of oxygen sensors before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**
- Removing and installing. Refer to **Oxygen sensors before catalytic converter, removing and installing**.

32 - Fuel pressure regulator

- Checking for vehicles up to 06.03. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**
- Integrated in fuel filter for vehicles as of 07.03
- Checking for vehicles as of 07.03. Refer to **System pressure and holding pressure (vehicles as of 07.03), checking**

33 - Knock Sensor (KS) 2 -G66-

- Bank 2
- Under intake manifold

34 - Intake manifold change-over valve -N156-

- Location. See **Fig. 105**
- Checking. Refer to **Intake manifold change-over, checking**

35 - Knock Sensor (KS) 1 -G61-

- Cylinder bank 1
- Under intake manifold

36 - Ground connection

- Right hand side engine support

37 - Not installed

Location of Throttle Position (TP) sensor -G79- and Sender 2 for accelerator pedal position -G185-

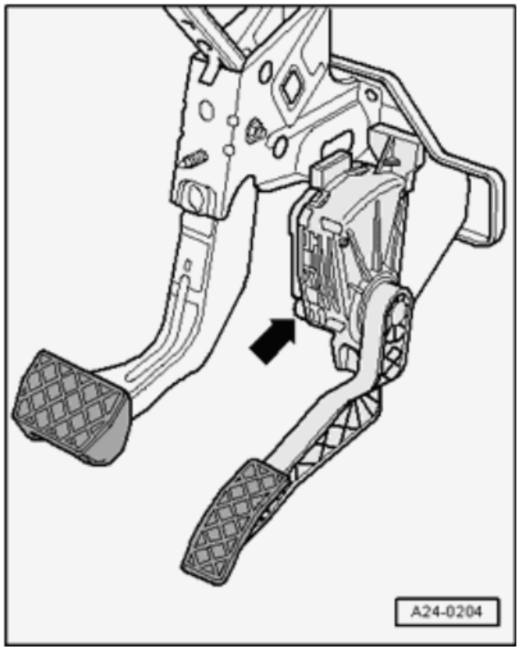

Fig. 96: Location Of Throttle Position (TP) Sensor -G79- And Sender 2 For Accelerator Pedal Position -G185-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Incorporated in accelerator pedal module (arrow)

NOTE: **The Throttle Position (TP) sensor -G79- and Sender -2- for accelerator pedal position -G185- are incorporated in the accelerator pedal module and cannot be replaced separately.**

Removing and installing gas pedal module:

Refer to **20 - FUEL SUPPLY SYSTEM**

Location of Fuel Pump (FP) relay -J17-

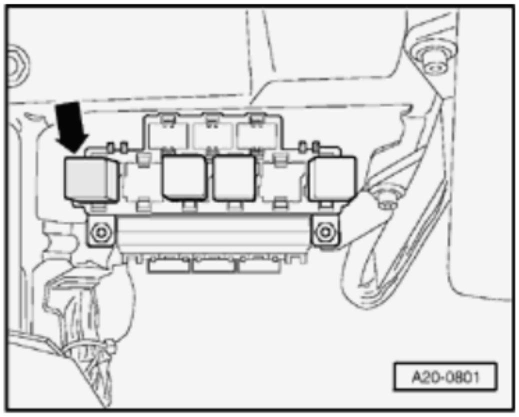

Fig. 97: Installed Location On 9-Socket Relay Carrier In Driver Footwell

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- On relay carrier in driver's footwell (left side), relay position 1 (arrow)

Location Brake light switch -F- and Brake pedal switch (cruise control/diesel direct fuel injection -F47-, Clutch vacuum vent valve switch -F36-

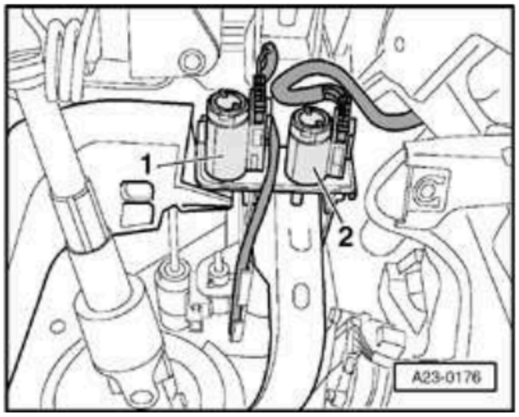

Fig. 98: Disconnecting Connector From Brake Light/Brake Pedal Switch -2-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Clutch Vacuum Vent Valve Switch -F36-

2 - Brake light switch -F-, Brake Pedal Switch (cruise control/Diesel Direct Fuel Injection -F47-

Removing and installing switches

Refer to

- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 012/01W FRONT WHEEL DRIVE
- **30 CLUTCH** for 5 SPD. MANUAL TRANSMISSION 01A ALL WHEEL DRIVE
- **30 CLUTCH** for 6 SPD. MANUAL TRANSMISSION 01E ALL WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 01X, FRONT-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 02X, FOUR-WHEEL DRIVE
- **30 CLUTCH** for 6-SPEED MANUAL TRANSMISSION 0A3, ALL WHEEL DRIVE

Refer to **46 - BRAKES - MECHANICAL COMPONENTS**

Location, Engine Control Module in electronics box (plenum chamber)

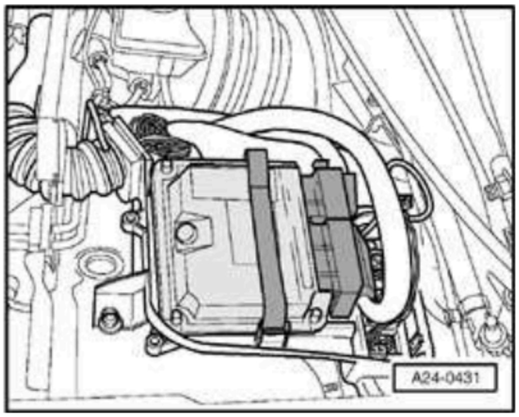

Fig. 99: Location, Engine Control Module In Electronics Box (Plenum Chamber)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Locations in electronics box (plenum chamber).

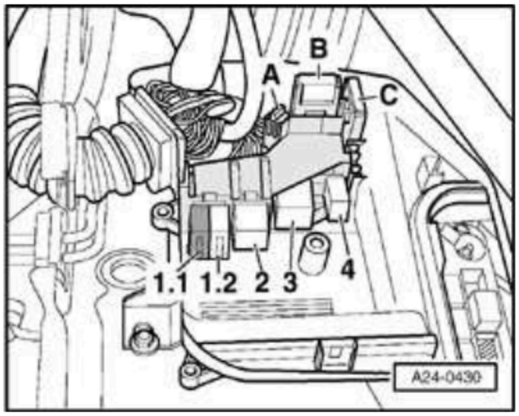

Fig. 100: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1.1 - Coolant circulation pump relay -J151- (hot countries only)

1.2 - Not used

2 - Motronic Engine Control Module (ECM) power supply relay -J271-

3 - Secondary Air Injection (AIR) pump relay -J299-

A - Fuse S282 for engine electronics

B - Fuse S130 for secondary air pump

C - Not used

Identification of connector bracket - right side of vehicle

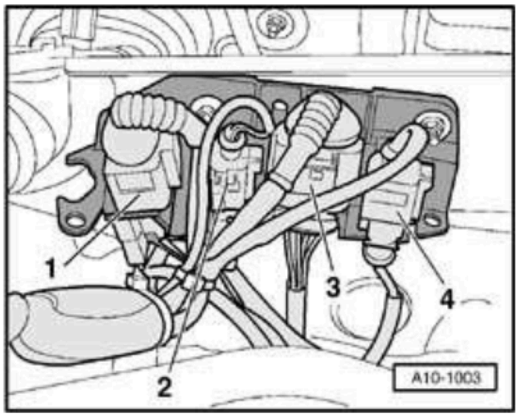

Fig. 101: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 6-pin connector, black

for Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) heater -Z19- (bank 1, sensor 1)

2 - 3-pin connector, blue

for Knock Sensor (KS) 1 -G61-

3 - 4-pin connector, green

for Oxygen Sensor (O2S) 2 behind three way catalytic converter (TWC) -G130- and Oxygen Sensor (O2S) heater 1 -Z29- (bank 1, sensor 2)

4 - 3-pin connector, black

for terminal 50

Identification of connector bracket - left side of vehicle

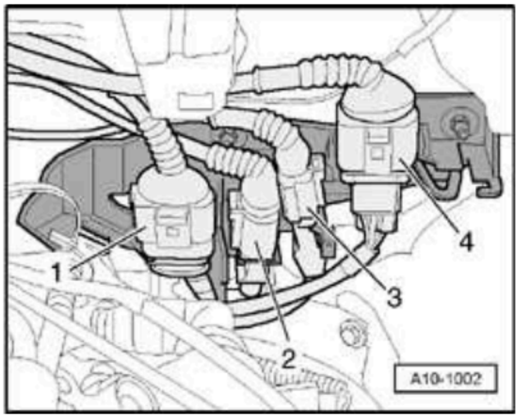

Fig. 102: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - 4-pin connector, brown

for Oxygen Sensor (O2S) 2 behind three way catalytic converter (TWC) -G131- and Oxygen Sensor (O2S) heater 2 -Z30- (bank 2, sensor 2)

2 - 3-pin connector, gray

for Engine speed (RPM) sensor -G28-

3 - 3-pin connector, blue

for Knock Sensor (KS) 2 -G66-

4 - 6-pin connector, black

for Heated Oxygen Sensor (HO2S) 2 -G108- and Oxygen Sensor (O2S) 2 heater -Z28- (bank 1, sensor 1)

NOTE:

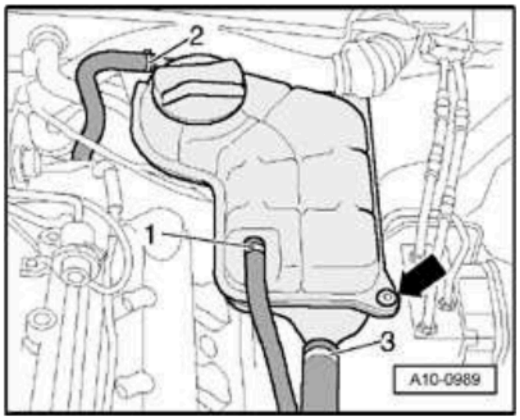

Fig. 103: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To gain access to the harness connectors, you must remove the cover on left side of engine compartment, disconnect cable to coolant shortage indicator switch at bottom of expansion tank, remove screw for coolant expansion tank (arrow) and lay aside. Coolant hoses -1 to 3- do not have to be disconnected.

Location of Brake booster pressure sensor -G294-

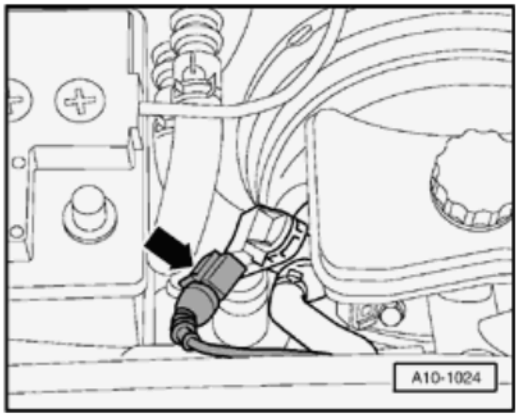

Fig. 104: Location Of Brake Booster Pressure Sensor -G294-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Location of Intake manifold change-over valve -N156-

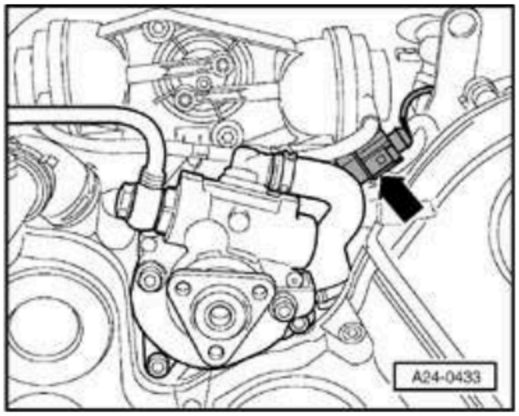

Fig. 105: Location Of Intake Manifold Change-Over Valve -N156-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Clipped to vacuum module

Air cleaner, disassembling and assembling

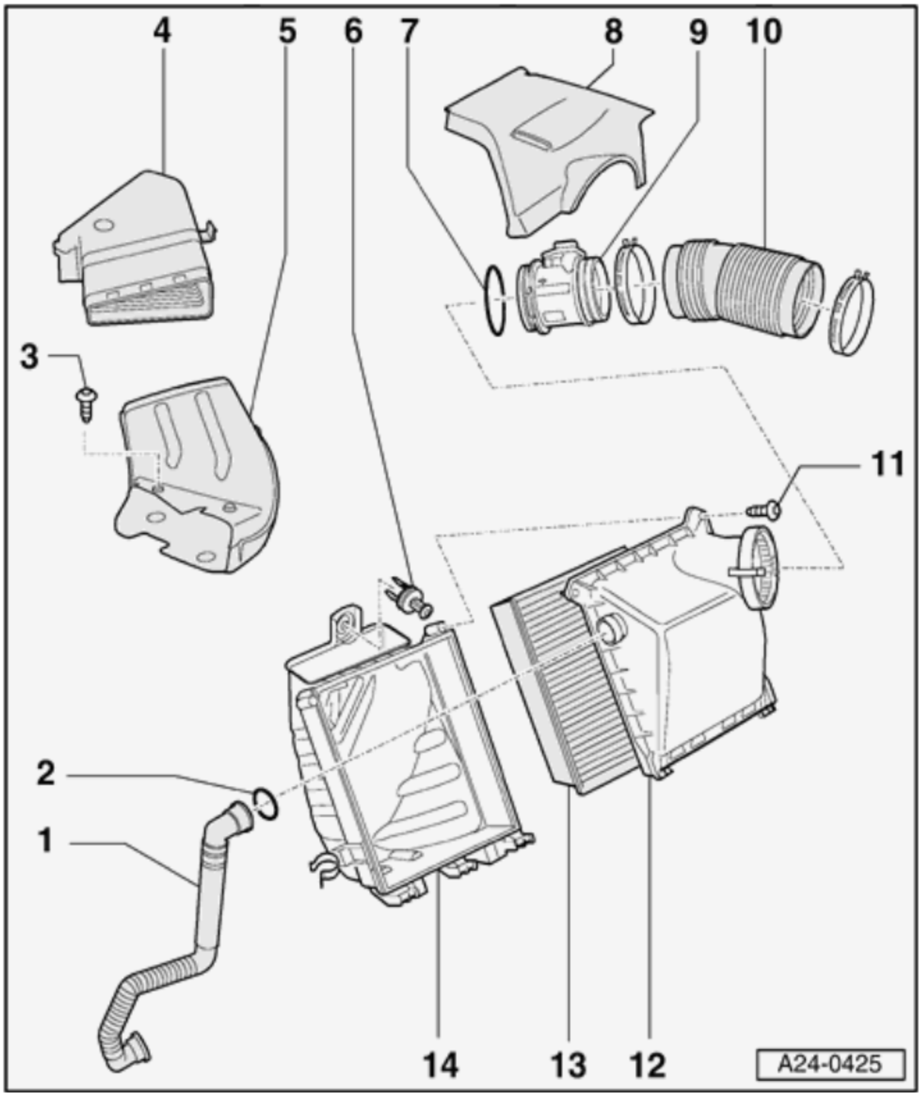

Fig. 106: Air Cleaner Remove/Install Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - To/from Secondary Air Injection (AIR) pump motor -V101-

2 - O-ring

- Always replace

3 - Self-tapping screw

4 - Air duct

5 - Air duct

- To lock carrier

6 - Spreader clip

7 - Seal

8 - Cover

9 - Mass Air Flow (MAF) sensor -G70-

10 - Connecting hose

11 - Self-tapping screw

12 - Air cleaner housing, upper part

13 - Filter element

14 - Air cleaner housing, lower part

Intake manifold change-over system components, removing and installing

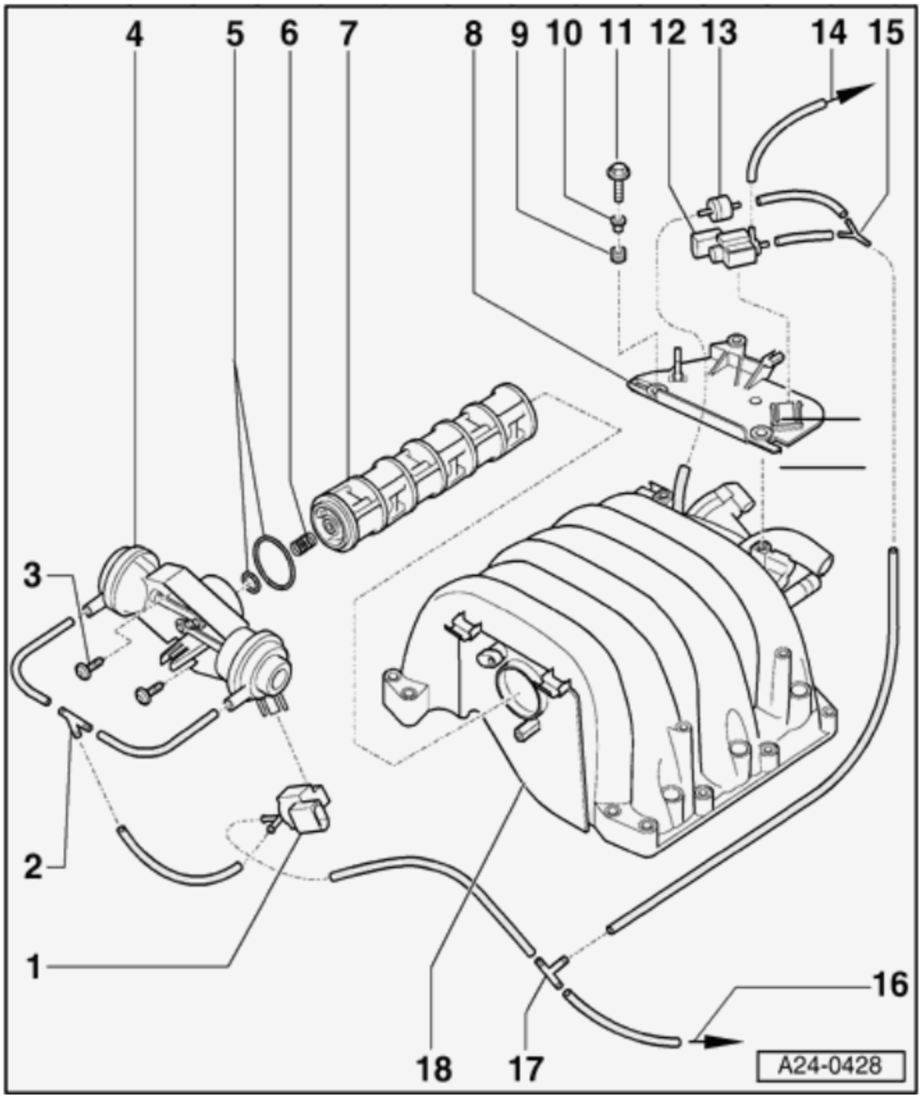

Fig. 107: Intake Manifold Change-Over System Components, Removing And Installing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Intake manifold change-over valve -N156-

2 - Y-piece

3 - Self-tapping screw

4 - Vacuum actuator

5 - Seals

- For change-over mechanism
- Replace, if damaged

6 - Spring

7 - Change-over mechanism

8 - Mounting plate

9 - Rubber grommet

10 - Spacer sleeve

11 - 10 Nm

12 - Secondary Air Injection (AIR) solenoid valve -N112-

13 - Non-return valve

- Installation position: Blue side facing Y-piece

14 - To secondary air inlet combi valves

15 - Y-piece

16 - To vacuum reservoir

17 - T-piece

18 - Intake manifold

Wiring and component check with test box VAG 1598/31

NOTE:

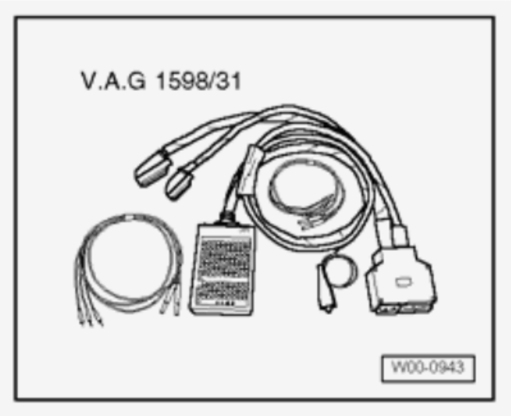

Fig. 108: V.A.G 1598/31 Test Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- **The test box VAG1598/31 is designed in such a way to be connected simultaneously to the engine control module wiring harness and to the**

engine control module.

- **This has the advantage that the electronic motor control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).**
- **Whether the engine control module has to be connected to the test box or not is described in the respective test procedures.**

- Switch ignition off.
- Remove engine control module. Refer to **Removing**.

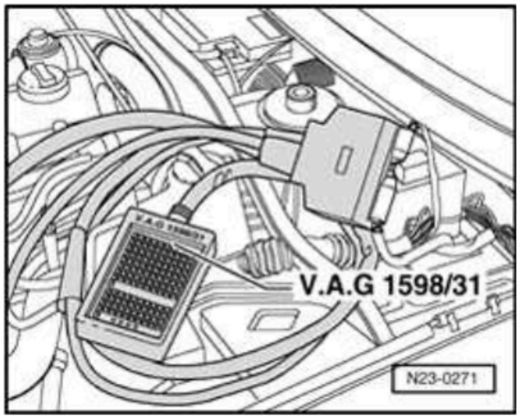

Fig. 109: VAG1598/31 Test Box Connected To Control Module Wiring Harness
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect VAG1598/31 test box to connectors of wiring harness. Connect Ground clamp on test box (not shown in illustration) to vehicle Ground. Whether or not engine control module has to be connected to test box is described in respective test procedures.

CAUTION: To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

NOTE: After reinstalling the engine control module the following operations must be performed:

- Checking of Diagnostic Trouble Code (DTC) memory and erase, if necessary. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- If DTC memory has been erased, readiness code must be regenerated. Refer to **Readiness code, generating**.

Procedure following interruption of voltage supply

NOTE: After reconnecting the voltage supply the following operations must be performed:

- Checking of Diagnostic Trouble Code (DTC) memory and erase, if necessary. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- If DTC memory has been erased, readiness code must be regenerated. Refer to **Readiness code, generating**.

Procedure after voltage supply open circuit

The following steps need to be performed after reconnecting the power supply:

- Activate engine control module via "Guided fault finding" function (diagnosis object "Replacing engine control module").

For this step use vehicle diagnostic, testing and information system VAS5051.

Engine Control Module (ECM) (without metal anti-theft housing), replacing

Removing ECMs with metal anti-theft housing. Refer to **Engine Control Module (ECM) (with metal anti-theft housing), replacing**.

Removing

- Connect vehicle diagnostic, test and information system VAS5051 and select vehicle system "01 - Engine electronics". Ignition must be on.

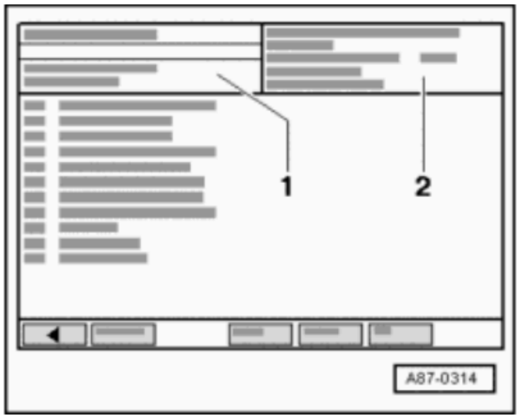

Fig. 110: Locating Control Module Identification With Code Indicated On The Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The display on vehicle diagnostic, test and information system VAS5051 will show the control module identification and the coding -2-.

- Always start by calling up and printing out control module identification.
- Switch off ignition.

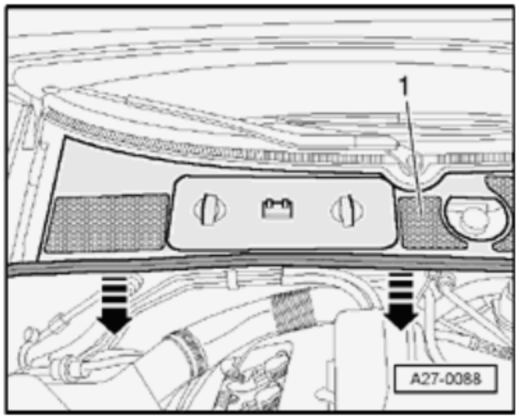

Fig. 111: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal of plenum chamber cover.
- Remove plenum chamber cover -1- toward front (arrows).

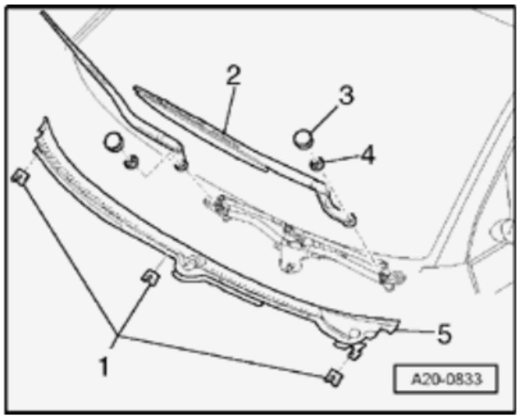

Fig. 112: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off cover caps -3- (2x) with a screwdriver.
- Loosen hex nuts -4- several turns.
- Disengage wiper arms -2- from their shafts by lifting them gently.
- Remove hex nuts completely and take off wiper arms.

- Pull off securing clips -1- and remove scuttle panel grille -5-.

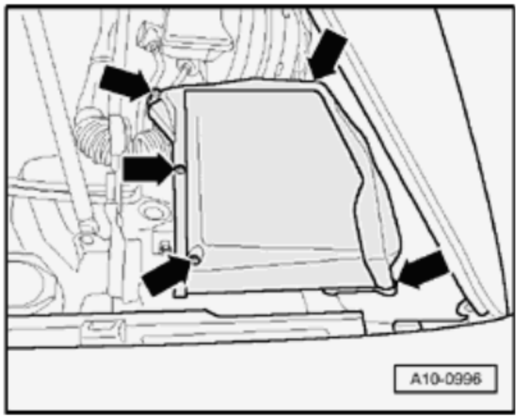

Fig. 113: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for electronics box in plenum chamber (arrows).

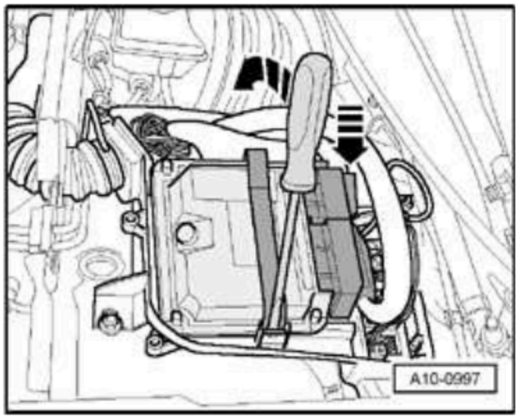

Fig. 114: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off retainer bar with a screwdriver (arrows).

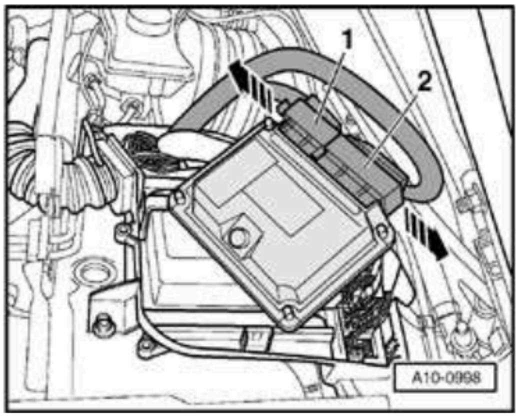

Fig. 115: Releasing Connector Latches And Pulling Off Connectors On Engine Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Release retainer catches (arrows) and disconnect connectors -1- and -2- from engine control module.
- Take out engine control module.

Installing

Install in reverse sequence; note the following points:

The following steps need to be performed after connecting the new engine control module:

- Activate engine control module via "Guided fault finding" function (diagnosis object "Replacing engine control module").

For this step use vehicle diagnostic, testing and information system VAS5051.

Engine Control Module (ECM) (with metal anti-theft housing), replacing

Removing ECMs without metal anti-theft housing. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Removing

- Connect VAS5051 tester and select vehicle system "01 - Engine Electronics". Ignition must be switched on for this.

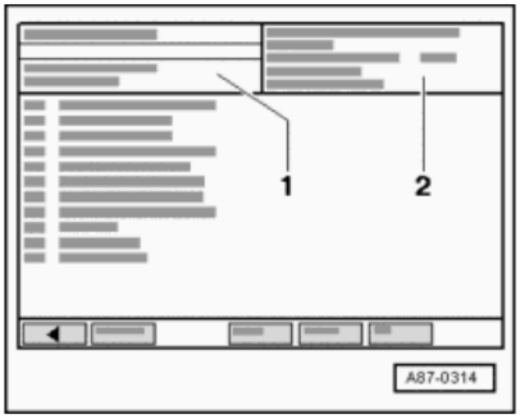

Fig. 116: Locating Control Module Identification With Code Indicated On The Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

VAS5051 tester display will indicate the control module identification and coding -2-.

- Always allow display of control module identification first and print it out.
- Switch ignition off.

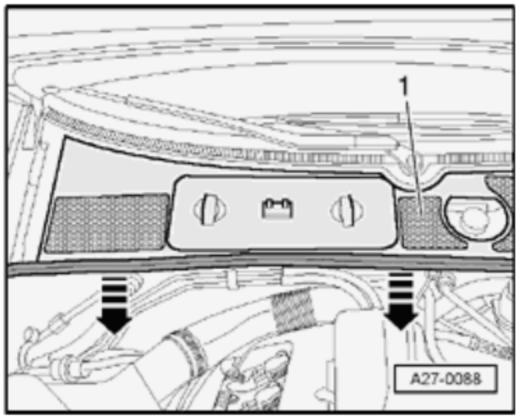

Fig. 117: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off plenum chamber cover rubber seal in direction of arrow.
- Remove cover -1- toward front.

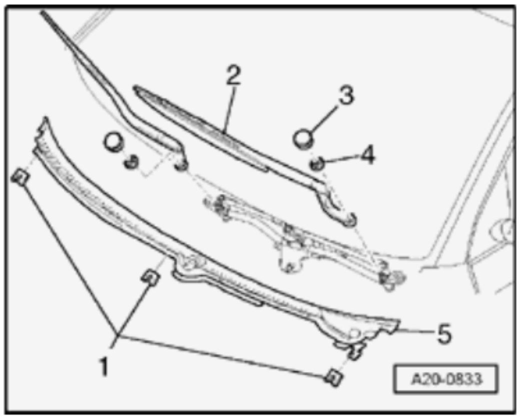

Fig. 118: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both covers -3- using a screwdriver.
- Loosen hex-nuts -4- several turns.
- Loosen wiper arm -2- by lightly tilting from wiper axle.
- Remove hex nuts completely and remove wiper arms.

- Disconnect securing clips -1- and remove cowl grill -5-.

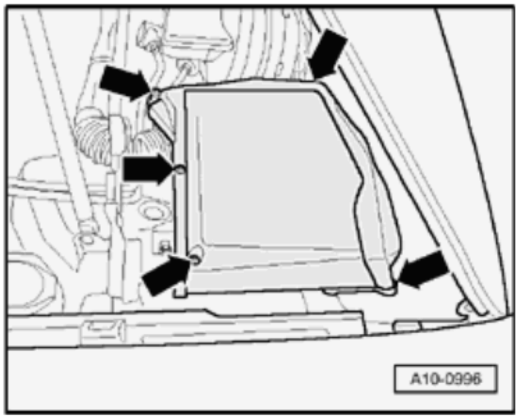

Fig. 119: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for E-box, plenum chamber (arrows).

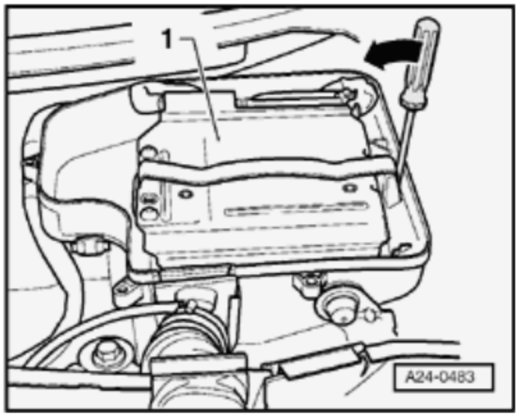

Fig. 120: Using Screwdriver To Pry Off Retaining Bracket
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Using a screwdriver, carefully pry off retaining bracket (arrow).

NOTE: **Item -1- in illustration shows Engine Control Module (ECM) with anti-theft housing.**

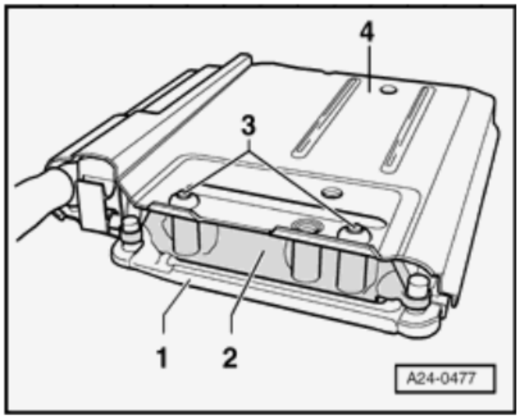

Fig. 121: ECM, Locking Mechanism, Screws And Anti-Theft Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To restrict accessibility (for theft prevention) to the harness connectors and the Engine Control Module (ECM), the ECM -1- is screwed to a metal anti-theft housing -4- via a locking mechanism -2- and snap-off screws -3-.

The threads of the snap-off screws are coated with a locking compound to make it more difficult to remove the snap-off screws.

To disconnect the harness connectors from the Engine Control Module (ECM) (e.g. when connecting a test box or when replacing the ECM), the ECM must be removed from the metal anti-theft housing. This procedure is described as follows.

The following equipment is required:

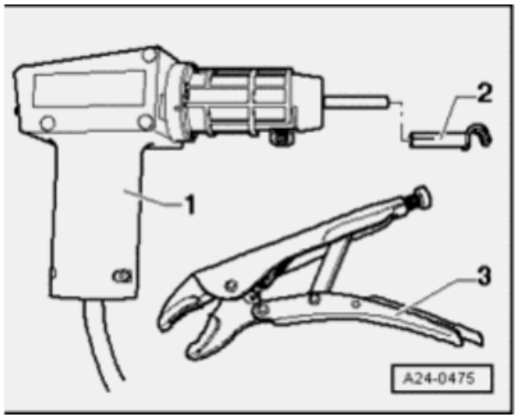

Fig. 122: Heat Gun, Adapter Nozzle And Pliers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Heat gun -1- (from VAS1978 Wiring Harness Repair Kit)
- Adapter nozzle -2- (also from VAS1978 Wiring Harness Repair Kit)
- Standard locking pliers

Procedure:

WARNING: **The following work steps must be adhered to exactly to avoid damage (burning) of wires, harness connectors, insulation and control modules! Observe operating instructions of heat gun.**

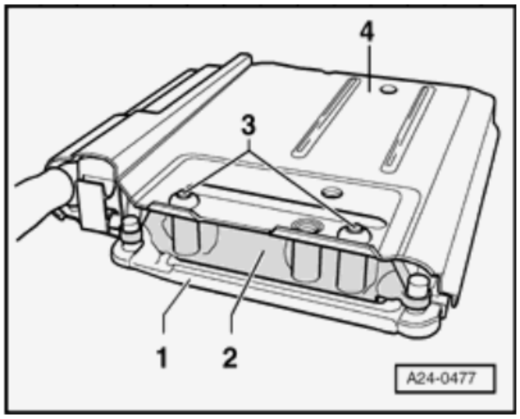

Fig. 123: ECM, Locking Mechanism, Screws And Anti-Theft Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- "Fold" Engine Control Module (ECM) with anti-theft housing in direction of engine compartment so that locking mechanism (item -2- in illustration) becomes visible and place a clean rag below Engine Control Module (ECM) with anti-theft housing.

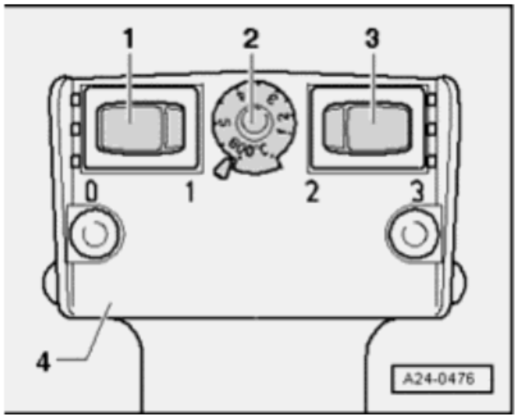

Fig. 124: Performing Adjustments On Hot Air Gun
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Adjust heat gun as shown in illustration, i.e. temperature adjustment -2- to maximum heat output and two-stage switch for air mass -3- to position 3.

NOTE: **Next, use a heat gun to heat the threads of the locking mechanism into which the snap-off screws are screwed into. This step loosens the locking compound on the threads of the snap-off screws for easier removal.**

WARNING: **By heating the locking mechanism threads, the snap-off screws and parts of the metal anti-theft housing will also become very hot. Be careful not to**

get burned! If possible, make sure that the threads and no other parts in the vicinity become heated. If necessary, cover them.

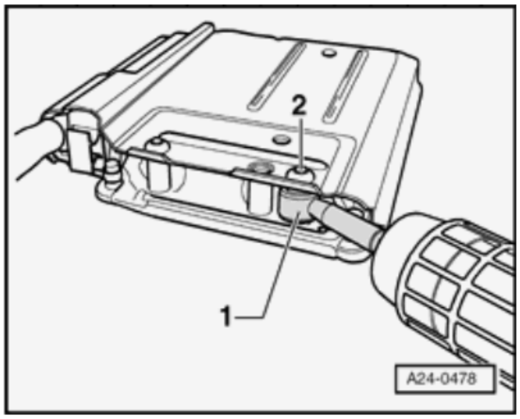

Fig. 125: Nozzle Of Heat Gun Guided To Locking Mechanism Threads So That Nozzle "Encloses" Threads
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide nozzle -1- of heat gun to locking mechanism threads so that nozzle "encloses" threads. It is OK to let nozzle make contact at upper end of metal anti-theft housing.
- Switch on heat gun and heat up threads for approx. 20 to 25 seconds.

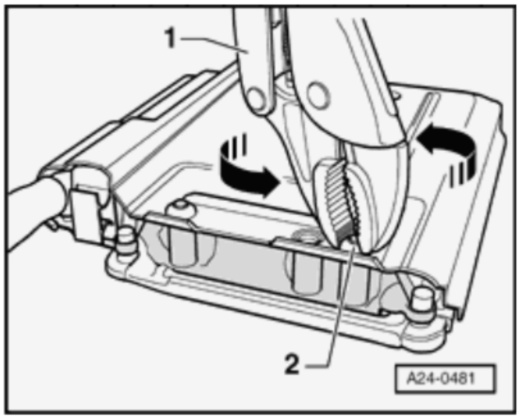

Fig. 126: Grabbing Screw Head And Removing Snap-Off Screw Using Locking Pliers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Next, using locking pliers -1-, grab screw head -2- and remove snap-off screw by turning in direction of arrow.

Procedure for the second snap-off screw is exactly the same. Be very careful since the control module connector is in close proximity.

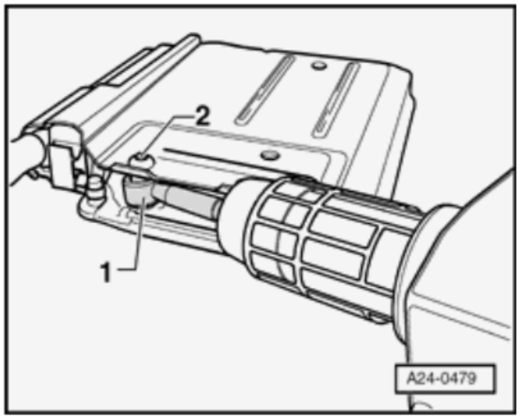

Fig. 127: Nozzle Of Heat Gun Guided To Locking Mechanism Threads Again So That Nozzle "Encloses" Threads
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Guide nozzle -1- of heat gun to locking mechanism threads again so that nozzle "encloses" threads. It is OK to let nozzle make contact at upper end of metal anti-theft housing.
- Switch on heat gun and heat up threads for approx. 20 to 25 seconds.

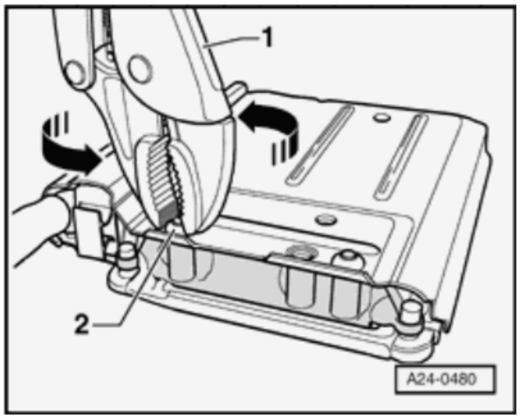

Fig. 128: Grabbing Screw Head And Removing Snap-Off Screw Using Locking Pliers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Next, using locking pliers -1-, grab screw head -2- and remove snap-off screw by turning in direction of arrow.

The Engine Control Module (ECM) can now be removed from the metal anti-theft housing.

- Disengage connectors from Engine Control Module (ECM) and disconnect connectors.
- Remove old Engine Control Module (ECM) and insert new one.

Installing Engine Control Module (ECM)

Installation is reverse of removal, noting the following:

After repairs are complete, the metal anti-theft housing must be reinstalled. Use new snap-off screws.

After connecting a new Engine Control Module (ECM), the following work steps must be performed:

- Activate Engine Control Module (ECM) in "Guided Troubleshooting" below subject heading "Engine Control Module (ECM), replacing".

Use VAS5051 tester to do so.

Idling speed, checking

Special tools and equipment

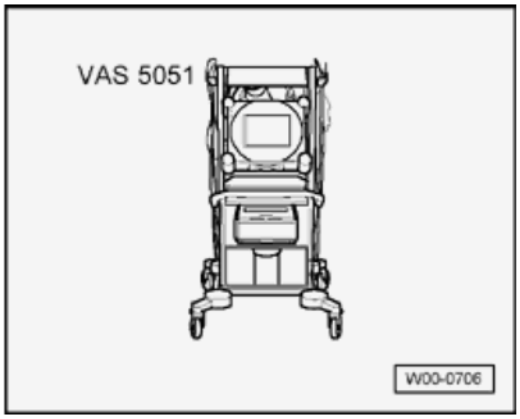

Fig. 129: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Test requirements

- No leaks in exhaust system
- Engine coolant temperature at least 80°C.
- Electrical accessories switched off (coolant fan must not run during the test).
- Air conditioning switched off.

- Pressure gauge not connected.
- Vehicles with automatic transmission: Selector lever in position P or N.

NOTE:

- **The idling speed is tested during the basic setting of the engine.**
- **During basic setting, the solenoid valve for the evaporative emission (EVAP) canister purge regulator valve -N80- is closed and the air conditioner compressor is switched off.**
- **To eliminate vibration noises in case of a customer complaint, the idling**

speed can be adapted. Refer to Adaptation.

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.
- Check Diagnostic Trouble Code (DTC) memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** . There must not be any DTCs stored. If necessary, correct any DTCs and erase DTC memory. After erasing DTC memory readiness code must be regenerated. Refer to **Readiness code, generating**.
- Leave engine idling.

CAUTION: The coolant fan should not be running.

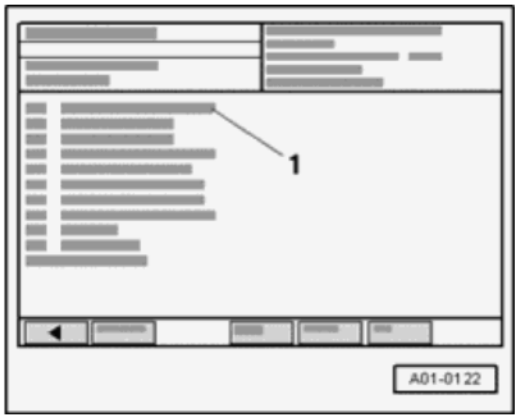

Fig. 130: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

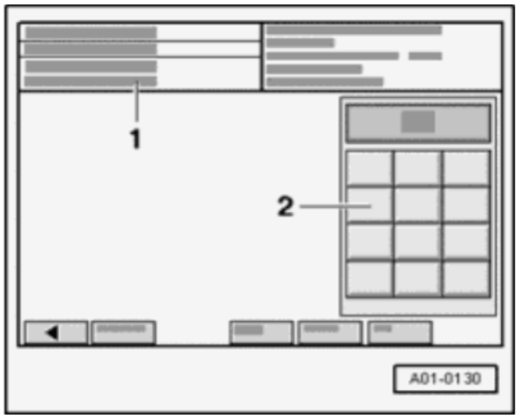

Fig. 131: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group max. input value = 255

- Enter "056" for "display group number 056" in zone -2- and confirm entry by pressing -Q- button.

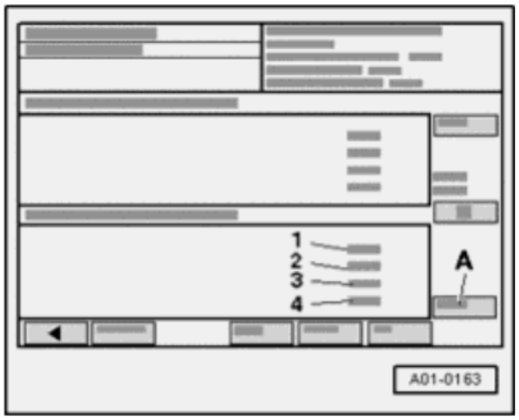

Fig. 132: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check whether engine speed in display zone -1- (actual speed) is within permitted tolerance range.

All models

	Display zones			
	1	2	3	4
Display group 056: Idling speed stabilization at operating temperature				
Display	**xxx RPM**	**xxx RPM**	x.x%	X X X X X
Display	**Engine speed (actual)**	**Engine speed (specified)**	Air mass of idling speed controller	Operating conditions
Specif. value	**700 to 800 RPM**	**750 RPM**	x.x%	0 0 0 0 0
Note:	If the specification is not obtained. Refer to **Idling speed, checking**			Significance of figures Refer to **Significance of 5-digit readout of display group 056**.

NOTE:

- **The engine speed in display zone 1 (actual speed) is the actual engine speed.**
- **The engine speed in display zone 2 (specified speed) is a theoretical value calculated by the engine control module.**
- **During idling, the engine control module always tries to adapt the actual engine speed to the specified engine speed.**
- **This means that during idling the actual engine speed must always be approximate to the specified engine speed.**
- **Display zones 3 and 4 are there for information but are irrelevant to the control of the engine idling speed.**

- ○ Exit function "04 - Basic setting" by pressing <-- button.

If specified value is not obtained:

- ○ Check Diagnostic Trouble Code (DTC) memory again. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- ○ If DTC memory was erased, readiness code must be re-generated. Refer to **Readiness code, generating**.

If the idling speed is too high or too low and there are no DTCs recorded in the DTC memory, perform the following tests marked with a dot:

- Check intake air system for unmetered air. Refer to **Intake air system for leaks (unmetered air), checking**.
- Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**.
- Check whether solenoid valve for Evaporative Emission (EVAP) canister purge regulator valve is continuously open. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking**.
- Perform adaptation of throttle valve control module. Refer to **Throttle valve control module -J338-, adaptation**.

Significance of 5-digit readout of display group 056

x	x	x	x	x	Display zone 4
0					Display always 0
	0				Rear window heating: 0 = rear window heating off; 1 = rear window heating on
		0			Air conditioner requirement: 0 = maximum

					heating/cooling output off, 1 = maximum heating/cooling output on
			0		Manual transmission: Display always 0 Driving mode for automatic transmission: 0 = selector lever in P or N; 1 = selector lever in R/D/S
				0	Air conditioner compressor: 0 = air conditioner compressor off; 1 = air conditioner compressor on

Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking

NOTE: **The fuel pressure regulator regulates the fuel pressure according to the intake manifold pressure. The pressure drop at the injectors remains constant for each engine speed and load range.**

Special tools and equipment

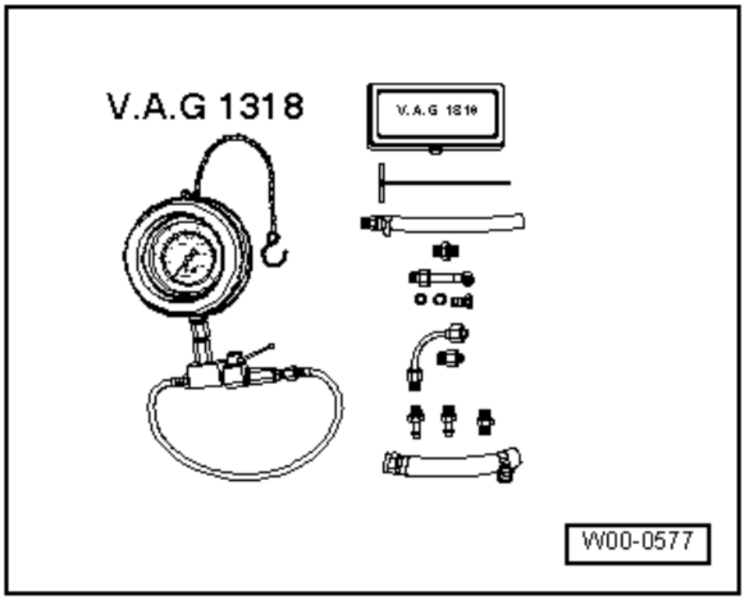

Fig. 133: Identifying Pressure Gauge V.A.G 1318
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAG1318 with VAG1318/6 and VAG1318/7

Test requirements:

- Fuel pump relay OK; checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**.
- Fuel pump OK; checking:

Refer to **20 - FUEL SUPPLY SYSTEM**

- Fuel filter OK
- Battery voltage at least 12.7 V
- Vehicles with automatic transmission: Selector lever in position P or N.

Test sequence

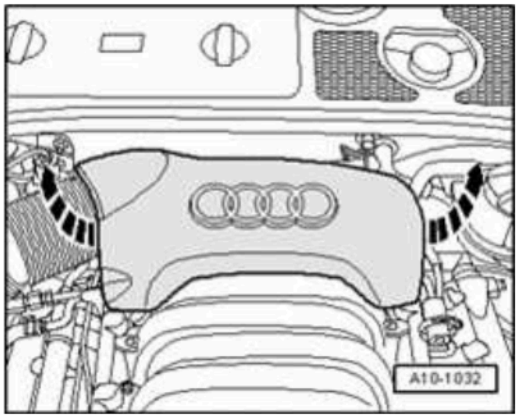

Fig. 134: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

Checking system pressure

WARNING: **The fuel system is under pressure! Place a cloth around the connection point before opening the system. Then carefully loosening the connection to relieve pressure.**

- Briefly open fuel tank filler cap (to release pressure).

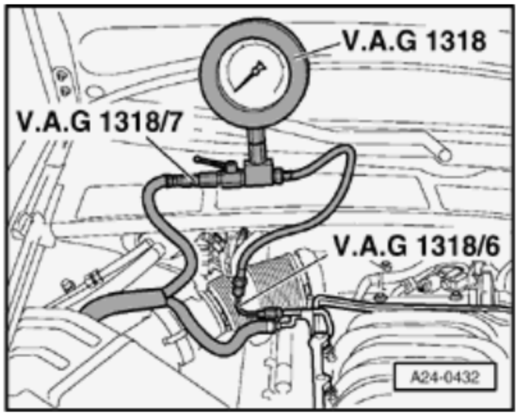

Fig. 135: Connecting Pressure Gauge VAG1318 To Fuel Supply Line Using Adapters 1318/6 And 1318/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect pressure gauge VAG1318 to fuel supply line using adapters 1318/6 and 1318/7.
- Disconnect vacuum hose from pressure regulator to intake manifold at pressure regulator and close off hose.

NOTE: **If fuel flows at the vacuum connection on the pressure regulator during the following pressure test, replace pressure regulator.**

- Start engine and run at idling speed.
- Measure fuel pressure.

- Specified value: 3.8 to 4.2 bar

- If fuel pressure does not match specification, install a new fuel pressure regulator and repeat pressure test.
- If fuel pressure still does not match specification, check fuel pump and supply line for damage (e.g. crushing) and replace if necessary.
- If pressure is higher than specification, check return line for damage (e.g. crushing) and replace, if necessary.

NOTE: **During the following test, do not leave the engine running too long with the vacuum hose disconnected, because the higher fuel pressure causes the fuel and air mixture to be rich. This could lead to the Oxygen sensor control limits to be exceeded. This would result in a DTC being recorded.**

- Start engine and run at idling speed.
- Switch off electrical accessories (air conditioner, etc.).
- Re-connect vacuum hose to pressure regulator and observe drop in pressure on pressure gauge.
- Fuel pressure must be lowered by approx. 0.5 bar when vacuum hose is attached.

Perform the following checks if there is no change in pressure as described above:

- Check vacuum hose for cracks and damage.
- Test vacuum hose for blockage at intake manifold. To do this, disconnect hose at fuel pressure regulator and blow into it.

- If there is no leak and no blockage in vacuum hose, install a new fuel pressure regulator.

Testing holding pressure

- Holding pressure 10 minutes after switching off engine (minimum pressure).

- Specified value for cold engine: approx. 2.2 bar
- Specified value with engine at operating temperature: approx. 3.0 bar

NOTE: **The increase in temperature with the engine at operating temperature is caused by the expansion of the fuel is normal.**

- Start engine and run at idling speed.

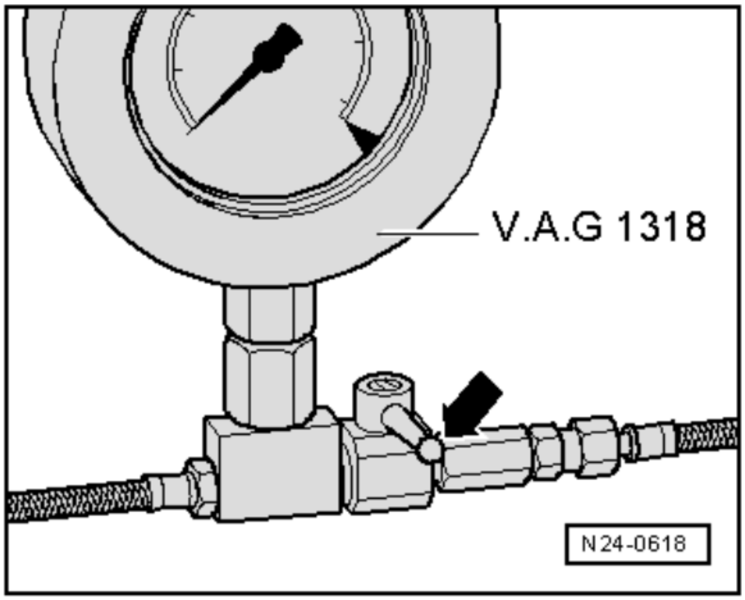

Fig. 136: Locating V.A.G 1318 Shut-Off Tap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Allow pressure to build up, then switch off ignition. At same time close cut off valve on pressure gauge VAG1318 (valve lever at right angles to direction of flow (arrow)).
- Observe pressure drop on pressure gauge.

If the pressure does not drop, the following DTCs are possible:

- Union between pressure gauge and fuel supply line leaking
- Supply line leaking at fuel tank
- Non-return valve in fuel pump leaking

Refer to **20 - FUEL SUPPLY SYSTEM**

NOTE: When the shut off valve is closed the pressure gauge shows the pressure after the isolating valve "intake manifold end" (direction of injectors, fuel pressure regulator). If the pressure before the isolating valve (tank direction) should now fall, the equipment cannot recognize this.

If the pressure drops again, the following DTCs are possible:

- Fuel pressure regulator malfunction
- Injectors leaking
- Unions on pressure gauge after cut-off valve leaking

NOTE: When disconnecting the pressure gauge, close the shut-off valve, unscrew the union on adapter VAG1318/15, then open the shut-off valve to drain off excess

fuel into a suitable container.

System pressure and holding pressure (vehicles as of 07.03), checking

NOTE: **Fuel pressure regulator is integrated in fuel filter (under fuel tank) and cannot be replaced individually.**

Recommended special tools and equipment

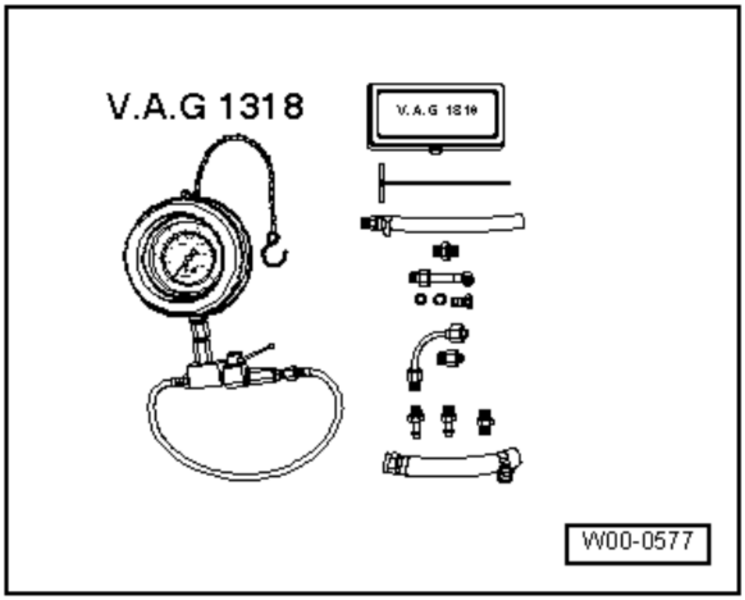

Fig. 137: Identifying Pressure Gauge V.A.G 1318
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel Inj. Pressure Gauge-CIS V.A.G 1318 with adapters V.A.G 1318/6 and V.A.G 1318/7

Test requirements:

- Fuel Pump (FP) Relay OK; checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**.
- Delivery quantity of transfer Fuel Pump (FP) OK

Refer to **20 - FUEL SUPPLY SYSTEM**

- Fuel filter OK
- Vehicles with automatic transmission: Selector lever in position "P" or "N".
- Battery voltage at least 12.7 V

Test sequence

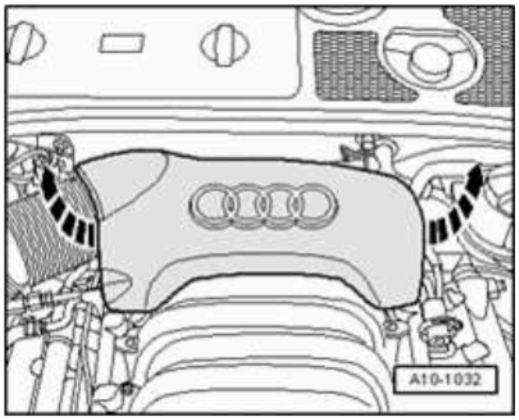

Fig. 138: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

Checking system pressure

- Open fuel filler cap briefly (pressure release).

WARNING: **Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.**

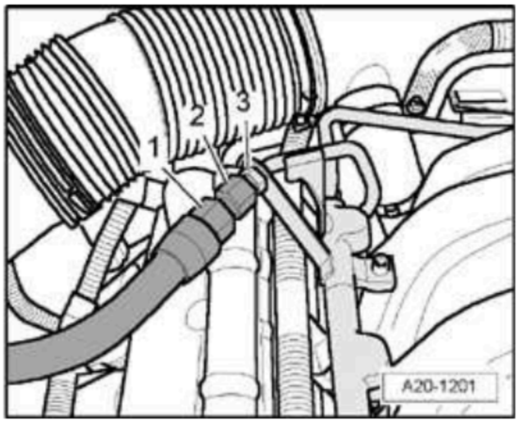

Fig. 139: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2-.

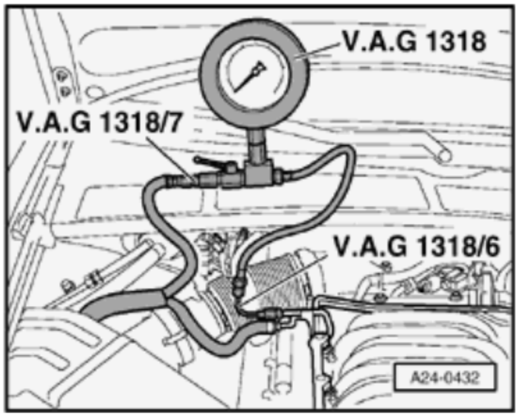

Fig. 140: Connecting Pressure Gauge VAG1318 To Fuel Supply Line Using Adapters 1318/6 And 1318/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1318 Fuel Inj. Pressure Gauge-CIS in supply line using adapters 1318/6 and 1318/7.

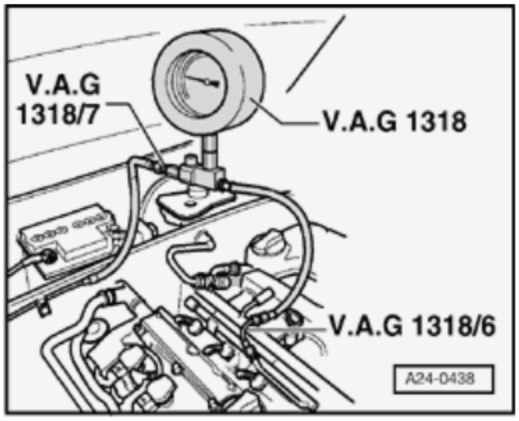

Fig. 141: Opening Shut-Off Valve Of Pressure Gauge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Open shut-off valve of pressure gauge. The lever points in the direction of flow.
- Start engine and let run at idle.
- Measure fuel pressure.

- Specified value: 3.8 to 4.2 bar

- Switch ignition off.

Checking holding pressure

- Check for proper seal and residual pressure by observing pressure drop on pressure gauge.

- Specified value with a cold engine: approx. 2.2 bar
- Specified value with the engine at operating temperature: approx. 3.0 bar

NOTE: Pressure increase for an engine at operating temperature due to fuel expansion is normal.

If holding pressure sinks below 2.2/3.0 bar positive pressure:

- Start engine and let run at idle.

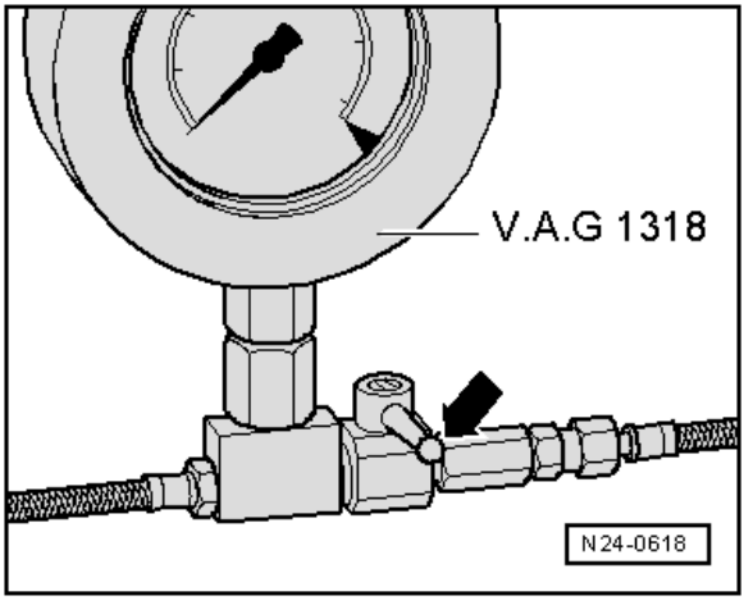

Fig. 142: Locating V.A.G 1318 Shut-Off Tap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wait until pressure has built up, and then switch off ignition. Simultaneously close shut-off valve of V.A.G 1318 Fuel Inj. Pressure Gauge-CIS (lever perpendicular to direction of flow -arrow-).
- Observe pressure drop on pressure gauge.

If pressure drops again:

- Check pressure gauge for proper seal.
- Check line connections and fuel injectors for proper seal.

If pressure does not drop now:

- Check pressure regulator in fuel filter:

- Vehicles with Front Wheel Drive (FWD). Refer to **Checking fuel pressure regulator - vehicles with Front Wheel Drive (FWD):**
- Vehicles with All Wheel Drive (AWD). Refer to **Checking fuel pressure regulator - vehicles with All Wheel Drive (AWD):**

Checking fuel pressure regulator - vehicles with Front Wheel Drive (FWD):

Sedan:

- Remove luggage compartment lining.
- Push forward the right backrest of rear seat, if necessary.

Station wagon:

- Remove left 1/3 backrest.

Refer to

- **72 - SEAT - FRAMES**
- **72 - SEAT - FRAMES** for BODY INTERIOR - CABRIOLET

- Remove left side trim in luggage compartment and dirt tray.

Refer to

- **70 - INTERIOR TRIM**
- **70 - INTERIOR TRIM** for BODY INTERIOR - CABRIOLET

All:

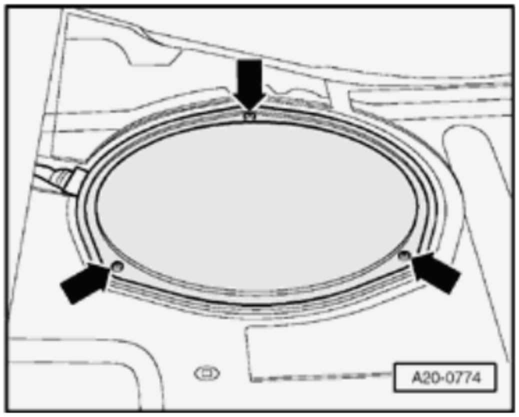

Fig. 143: Unbolting Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for connector flange (arrows).

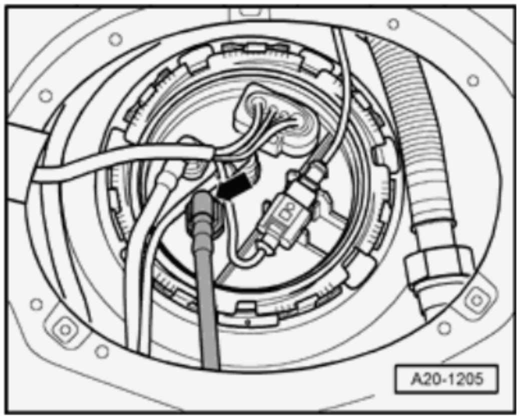

Fig. 144: Disconnecting Fuel Return Line By Pressing Release Buttons
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel return line (arrow) (press release button).

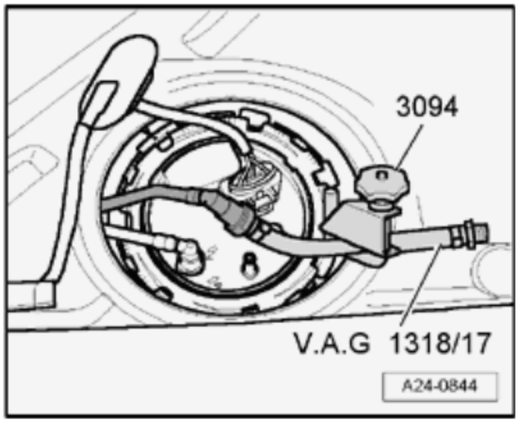

Fig. 145: Connecting V.A.G 1318/17-1 Adapter Piece To Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1318/17-1 adapter piece to return line.
- Pinch off adapter piece using 3094 hose clamps up to 25 mm dia.

NOTE: 3094 hose clamps up to 25 mm dia. must not be placed directly on fuel line, otherwise it may be damaged.

- Start engine and let run at idle.

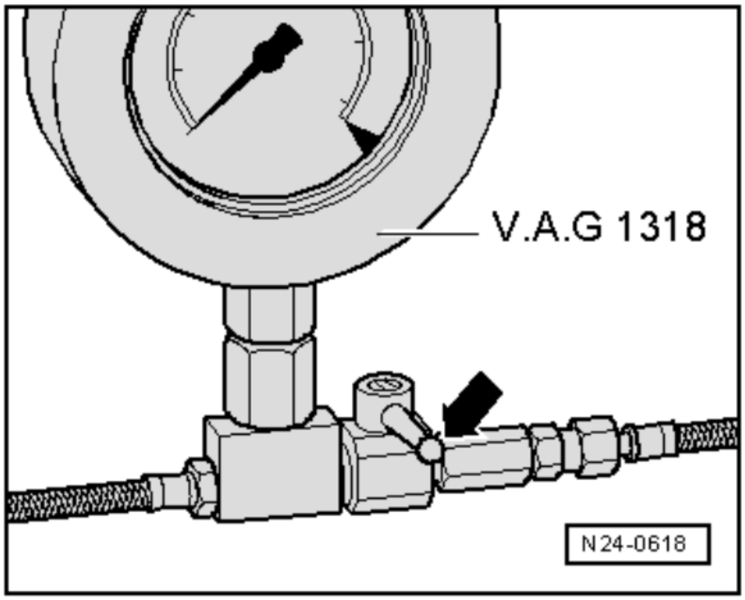

Fig. 146: Locating V.A.G 1318 Shut-Off Tap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wait until pressure has built-up, and then switch off ignition. Simultaneously close shut-off valve of V.A.G 1318 Fuel Inj. Pressure Gauge-CIS (lever perpendicular to direction of flow -arrow-).
- Observe pressure drop on pressure gauge.

If pressure drops again, check-valve of fuel pump is leaky.

- Replace Fuel Pump (FP).

Refer to **20 - FUEL SUPPLY SYSTEM**

If pressure does not drop now:

- Replace fuel filter with integrated fuel pressure regulator.

Assembly is performed in the reverse order of removal, noting the following:

NOTE: Before disconnecting pressure gauge, release pressure by opening shut-off valve. Hold a container in front of connection for this.

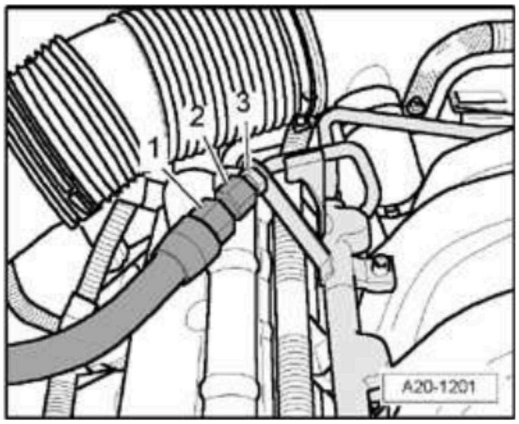

Fig. 147: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Checking fuel pressure regulator - vehicles with All Wheel Drive (AWD):

- Remove rear seat bench.

Refer to

- **72 - SEAT - FRAMES**
- **72 - SEAT - FRAMES** for BODY INTERIOR - CABRIOLET

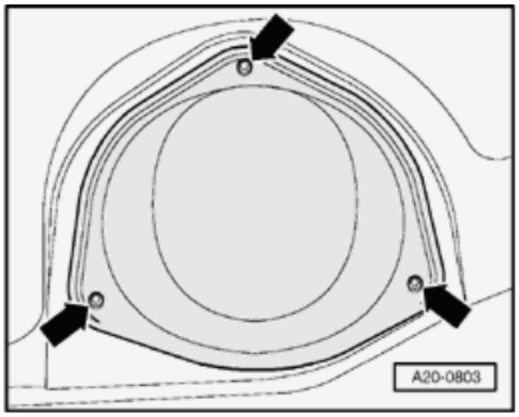

Fig. 148: Removing Cover Bolts For Locking Flange
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for left connector flange (arrows).

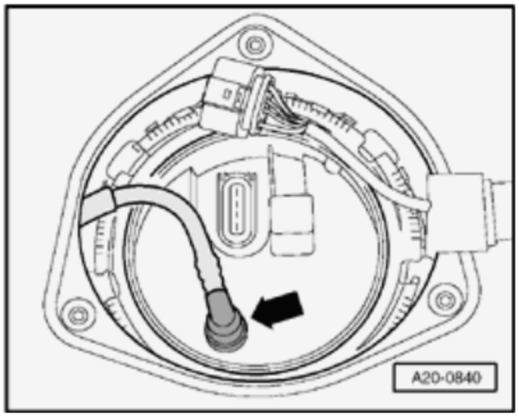

Fig. 149: Disconnecting Fuel Return Line From Connector Flange (Left Side Of Vehicle)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuel return line (arrow) from connector flange (left side of vehicle).

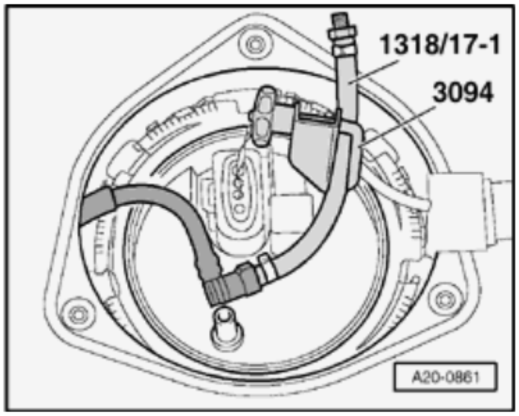

Fig. 150: Connecting V.A.g 1318/17-1 Adapter Piece To Return Line
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect V.A.G 1318/17-1 adapter piece to return line.
- Pinch off adapter piece using 3094 hose clamps up to 25 mm dia.

NOTE: 3094 hose clamps up to 25 mm dia. must not be placed directly on fuel line, otherwise it may be damaged.

- Start engine and let run at idle.

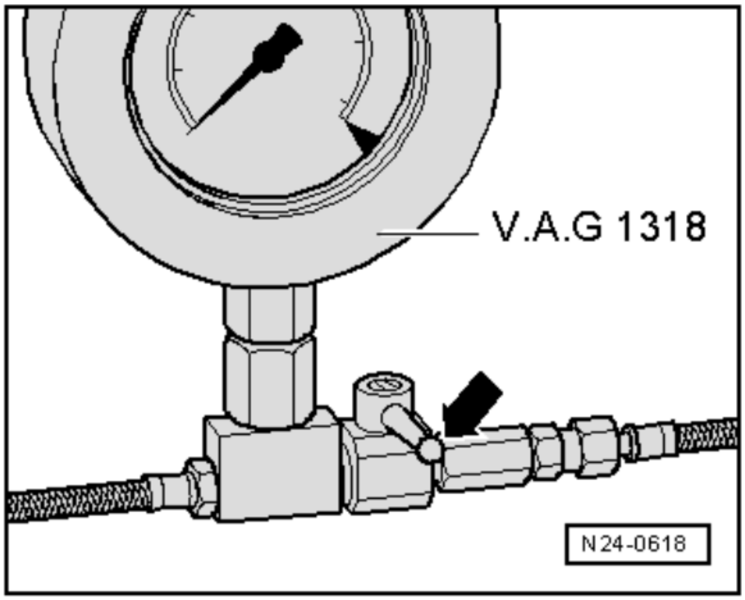

Fig. 151: Locating V.A.G 1318 Shut-Off Tap
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wait until pressure has built-up, and then switch off ignition. Simultaneously close shut-off valve of V.A.G 1318 Fuel Inj. Pressure Gauge-CIS (lever perpendicular to direction of flow -arrow-).
- Observe pressure drop on pressure gauge.

If pressure drops again, check-valve of fuel pump is leaky.

- Replace Fuel Pump (FP).

Refer to **20 - FUEL SUPPLY SYSTEM**

If pressure does not drop now:

- Replace fuel filter with integrated fuel pressure regulator.

Assembly is performed in the reverse order of removal, noting the following:

NOTE: **Before disconnecting pressure gauge, release pressure by opening shut-off valve. Hold a container in front of connection for this.**

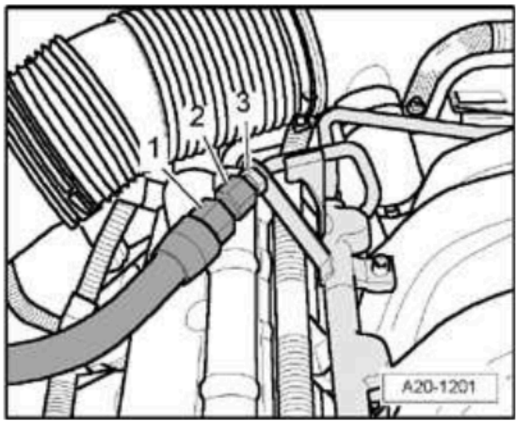

Fig. 152: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Fuel injectors, checking

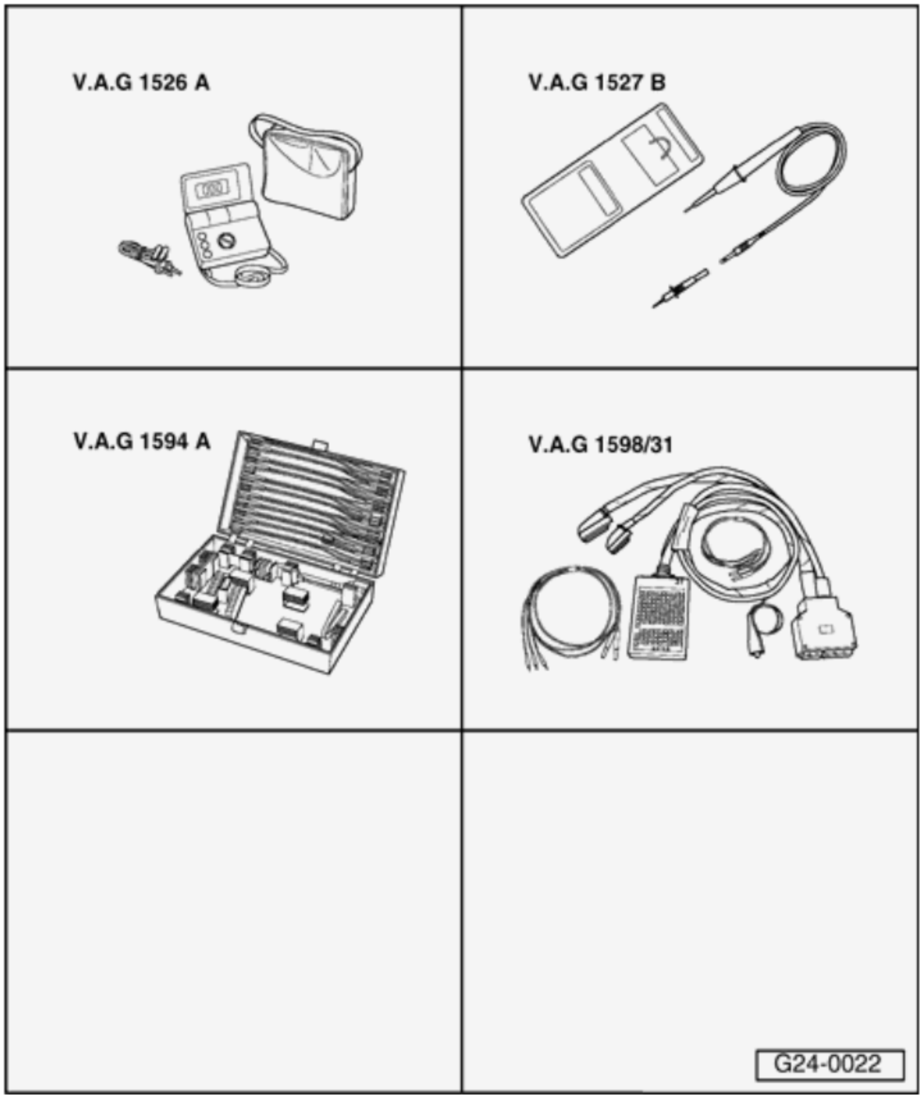

Fig. 153: Identifying Special Tools - Fuel Injectors, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

Procedure

Cylinder bank 2 (left)

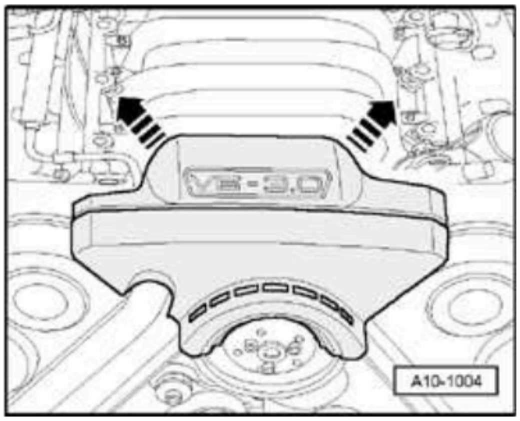

Fig. 154: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

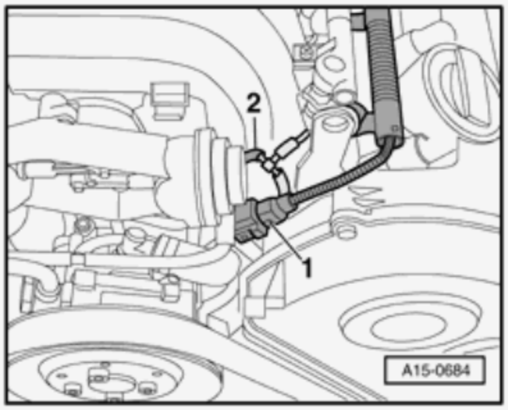

Fig. 155: Disconnecting Electrical Harness Connector & Pulling Off Vacuum Hose At T-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors to Intake manifold change-over valve -N156- -1-.

Both cylinder banks, continued

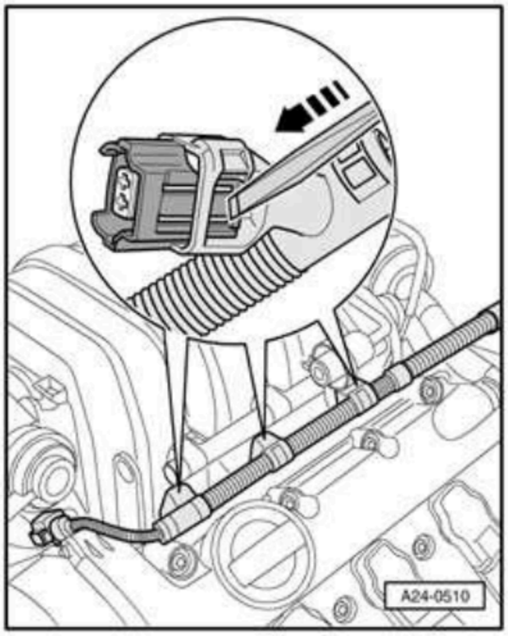

Fig. 156: Disconnecting All Connectors For Injectors Of Relevant Cylinder Bank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect all connectors for injectors of relevant cylinder bank, release connectors underneath for this purpose (arrow).

Checking internal resistance

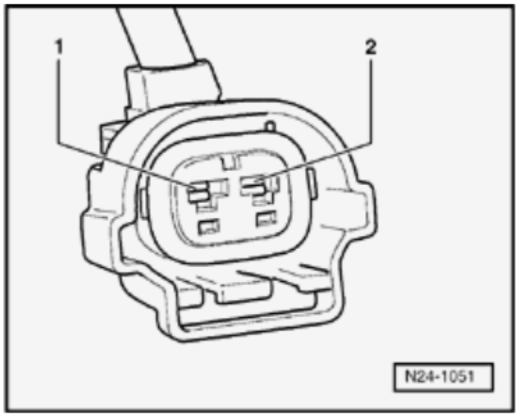

Fig. 157: 2-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter to injector to measure resistance.

- Specified value: 11 to 13 ohms (at room temperature)

When the engine is at operating temperature the resistance is increased by approx. 4 to 6 ohms.

If specified value is not obtained:

- Replace injector. Refer to **Fuel injectors, removing and installing**

If specified value is obtained:

Checking power supply

Test requirements

- Fuse for injectors OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Fuel pump relay OK; checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**.

NOTE: The injectors receive their power supply via the fuel pump relay.

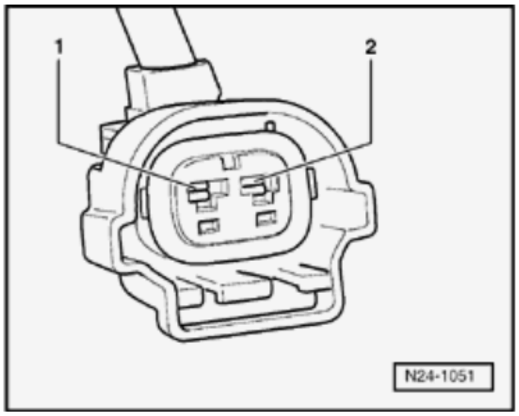

Fig. 158: 2-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B as follows:

Connector Terminal	Measure to
1	Engine ground

- Switch ignition on.
- LED should illuminate.

If the LED does not illuminate:

- Check wiring connection between terminal 1 and fuse for injector for open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit, if necessary.

If the LED illuminates:

Checking actuation

Test requirements

- Internal resistance of the valve OK

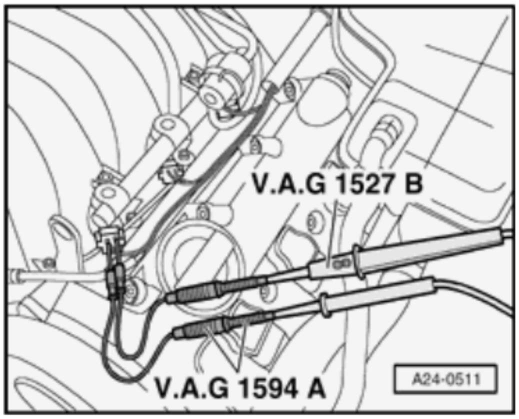

Fig. 159: Connecting Voltage Tester VAG1527 B With Measuring Probes And Plug-In Adapters From VAG1594 A Between Terminal 2 (Signal) And Terminal 1 (Positive)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B with measuring probes and plug-in adapters from VAG1594 A between terminal 2 (signal) and terminal 1 (positive); connector remains plugged in.
- Operate starter briefly (engine may start).

- LED should flash.

NOTE: Voltage testers with a low current draw continue to glow faintly between actuation from the engine control module (rather than extinguishing completely) and become slightly brighter when actuated.

If LED does not flash:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

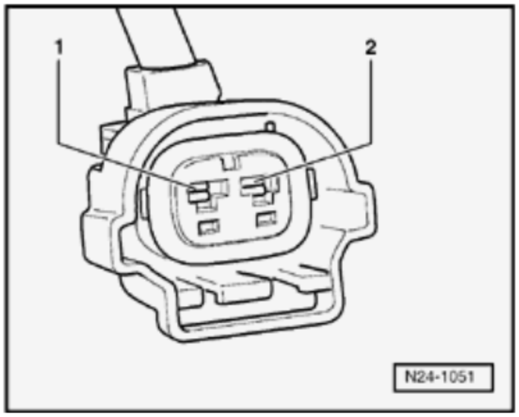

Fig. 160: 2-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connections:

Cylinder	Injector connector Terminal	Test box VAG 1598/31 Socket
1	2	96
2	2	112
3	2	88
4	2	97
5	2	113
6	2	89

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Fuel rail with injectors, disassembling and assembling

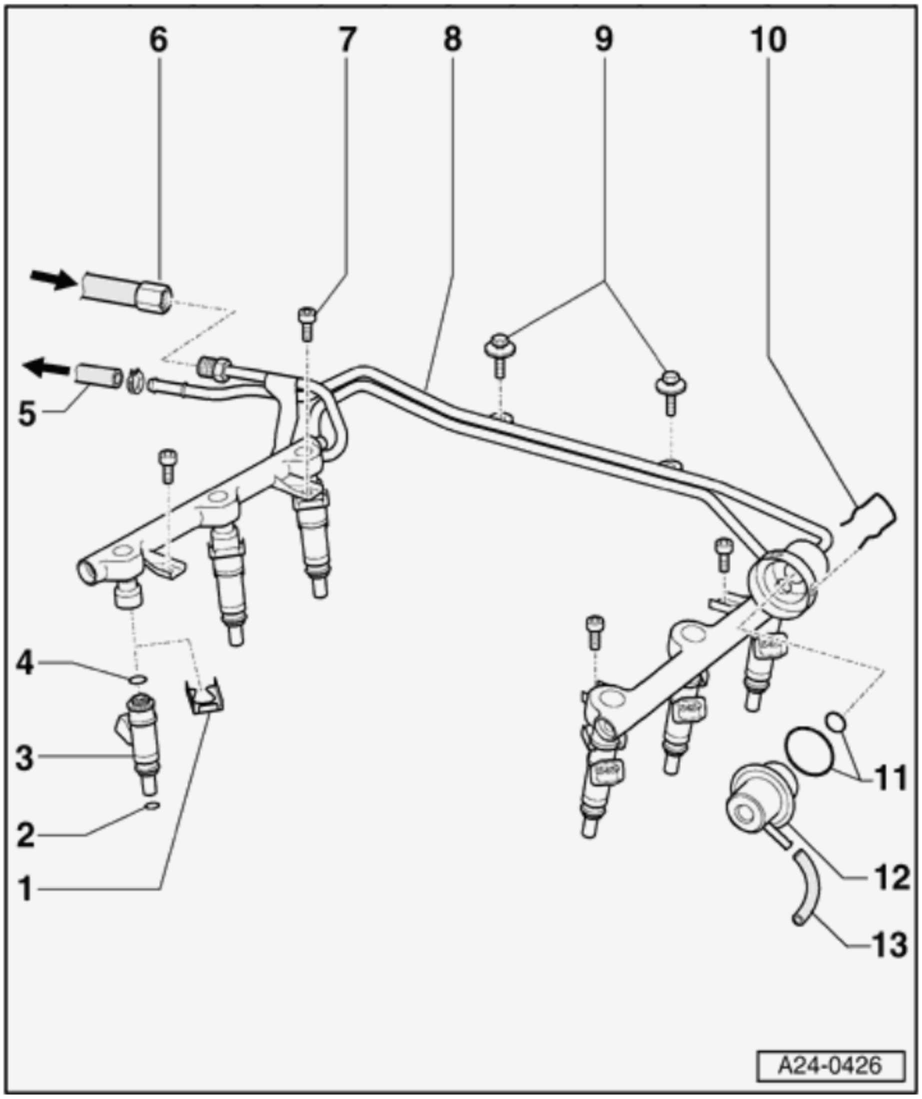

Fig. 161: Fuel Rail With Injectors, Disassembling And Assembling Overview
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - Retaining clip

- Make sure clip is positioned correctly at injector and fuel rail

2 - O-ring

- Removing and installing. Refer to **Fuel injectors, removing and installing**.
- Always replace
- Coat with clean engine oil.

3 - Injector

- Removing and installing. Refer to **Fuel injectors, removing and installing**.

4 - O-ring

- Removing and installing. Refer to **Fuel injectors, removing and installing**.
- Always replace
- Coat with clean engine oil.

5 - Fuel return line

- Only in vehicles up to 06.03

6 - Fuel supply line

- For vehicles up to 06.03, tighten union nut to 22 Nm
- Loosening and tightening union in vehicles as of 07.03. See **Fig. 162**

WARNING: **Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.**

7 - 10 Nm

8 - Fuel rail

9 - 10 Nm

10 - Retaining clip

- Make sure tight fit

11 - O-rings

- Always replace
- Moisten with clean engine oil.

12 - Fuel pressure regulator

- Integrated in fuel filter in vehicles as of 07.03

13 - Vacuum hose

Loosening and tightening union nut for fuel supply line in vehicles as of 07.03

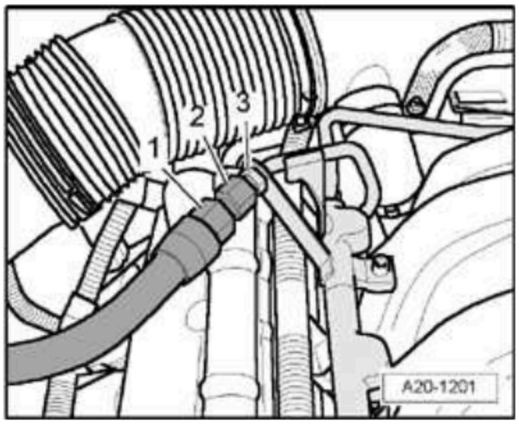

Fig. 162: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

WARNING: **Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.**

Loosening:

- Unscrew fuel hose from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2-.

Tightening:

- Secure fuel hose to connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and tighten union nut -2- to 22 Nm.

Fuel injectors, removing and installing

Removing

- Disconnect battery Ground cable.

Refer to

- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL** for ELECTRICAL EQUIPMENT, CABRIOLET

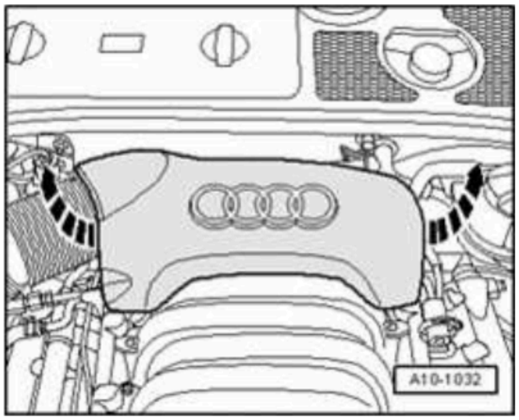

Fig. 163: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).
- Disconnect check valve hose.

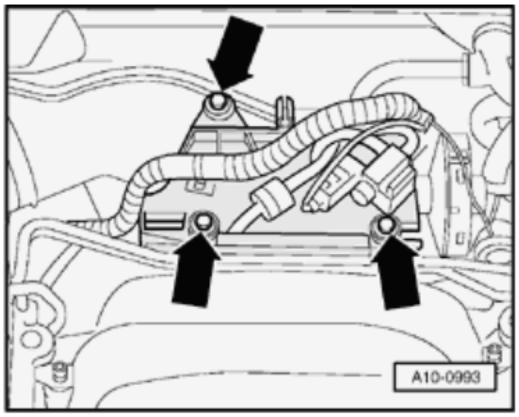

Fig. 164: Removing Bolts For Holding Plate For Solenoid Valves
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for retainer plate for solenoid valve (arrows).
- Lift up retainer plate and move it toward rear of engine.

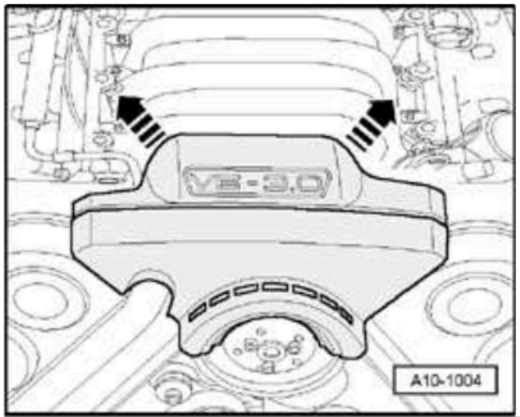

Fig. 165: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

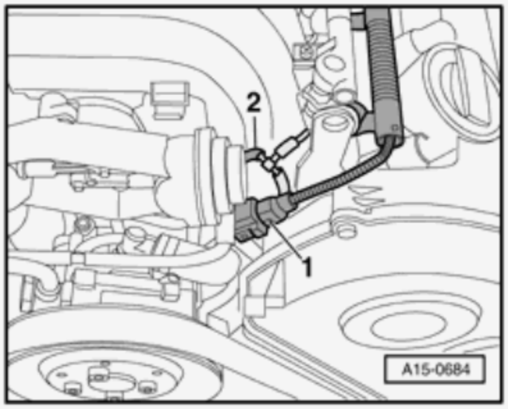

Fig. 166: Disconnecting Electrical Harness Connector & Pulling Off Vacuum Hose At T-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect harness connectors to Intake manifold change-over valve -N156- -1-.

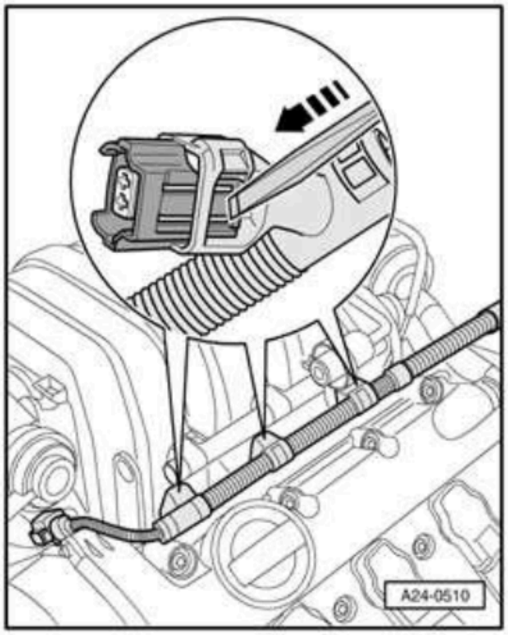

Fig. 167: Disconnecting All Connectors For Injectors Of Relevant Cylinder Bank
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Gently lift up fuel rail and disconnect all harness connectors at fuel injectors. Disengage harness connectors underneath (arrow).

Vehicles up to 06.03

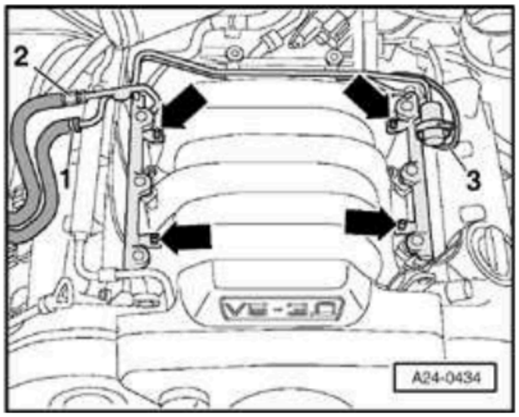

Fig. 168: Disconnecting Vacuum Hose -3- From Fuel Pressure Regulator
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose -3- from fuel pressure regulator.

NOTE: To install a new fuel rail disconnect the fuel supply line -2- and return line -1-.

WARNING: The fuel system is under pressure! Place a cloth around the connection point before opening the system. Then open the connection carefully to relieve pressure.

All:

- Unbolt fuel rail from intake manifold (arrows).

Vehicles as of 07.03:

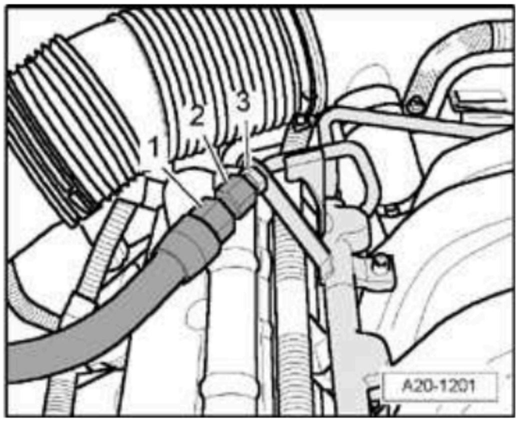

Fig. 169: Unscrewing/Screwing Fuel Hose From Connection On Fuel Rail Pipe
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To replace the fuel rail pipe, fuel hose must be unscrewed from connection on fuel rail pipe. To do so, counterhold using an open-end wrench at each hex head -1- and -3- and unscrew union nut -2- (tightening torque 22 Nm).

WARNING: Fuel system is under pressure! Before opening system, place rags around the connection. Then release pressure by carefully loosening connection.

All:

- Remove fuel rail together with injectors from intake manifold and place it on a clean cloth at back of engine compartment.
- Remove retaining clip and remove injector.

Installing

Install in reverse order, note the following:

- Replace the O-rings at all opened connections.
- Coat the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct positions.
- Check to make sure that the retainer clamps are properly seated.

- Position fuel rail with injectors on intake manifold and press evenly into place.

Tightening torque

Component	Nm
Fuel rail to intake manifold	10

Injection quantity, leak tightness and spray pattern of injectors, testing

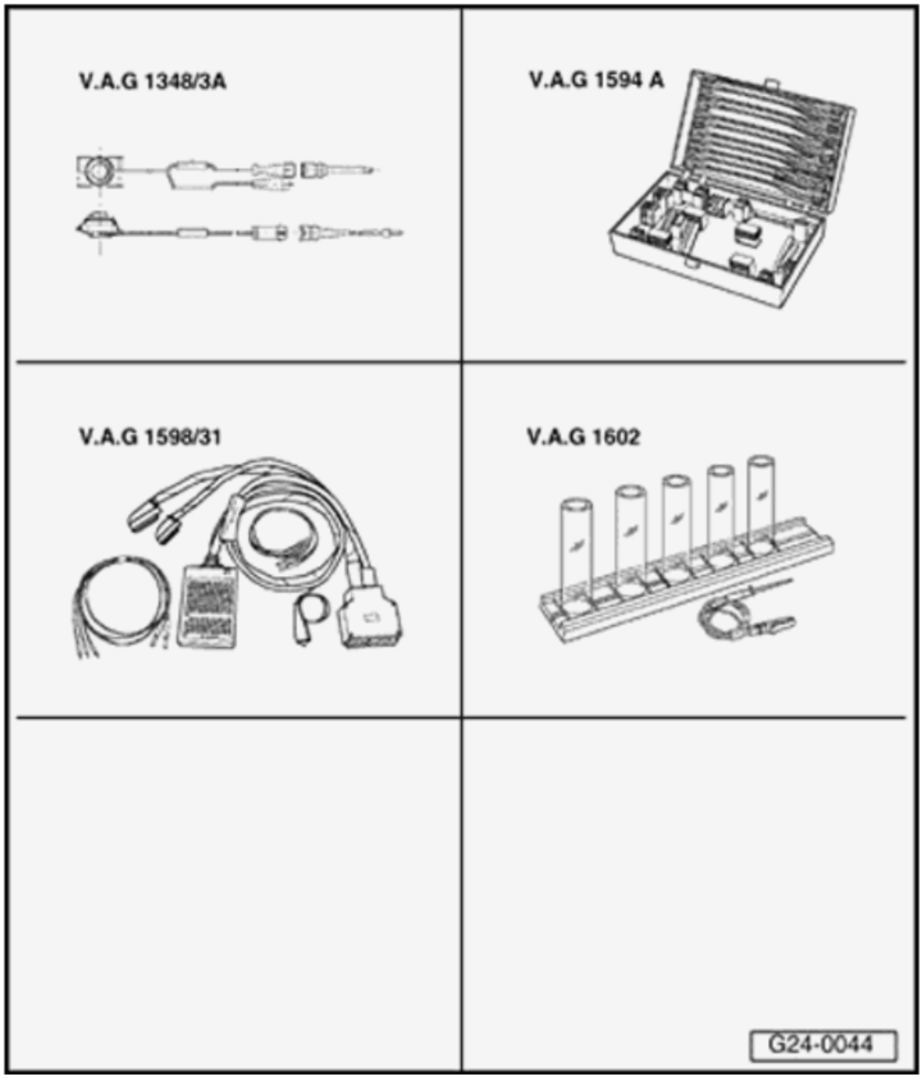

Fig. 170: Identifying Special Tools - Injection Quantity, Leak Tightness And Spray Pattern Of Injectors, Testing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1348/3A with 1348/3-2
- VAG1594 A
- VAG1598/31
- VAG1602

Test requirements

- Fuel pressure OK, checking. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**.

Test sequence

- Remove fuel rail with injectors installed from intake manifold. Refer to **Fuel injectors, removing and installing**. Do not disconnect fuel hoses.
- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

Testing for leaks

- Bridge terminals 1 and 65 at test box using test leads adapter kit VAG1594A.
- Switch ignition on.

- Fuel pump should run.

- Check injectors for leaks (visual check). When fuel pump is running, only 1 or 2 drops a minute should escape from each injector.
- If a greater amount of fuel escapes, switch off fuel pump (disconnect cable bridge) and replace faulty injector. Refer to **Fuel injectors, removing and installing**;

Checking injection quantity

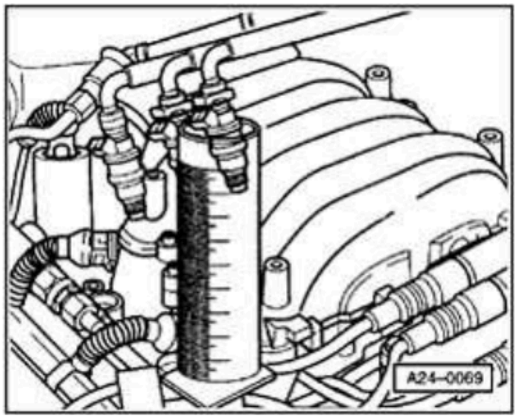

Fig. 171: Checking Injection Quantity
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Place injector which is to be tested in a measuring glass from injection quantity tester VAG1602.

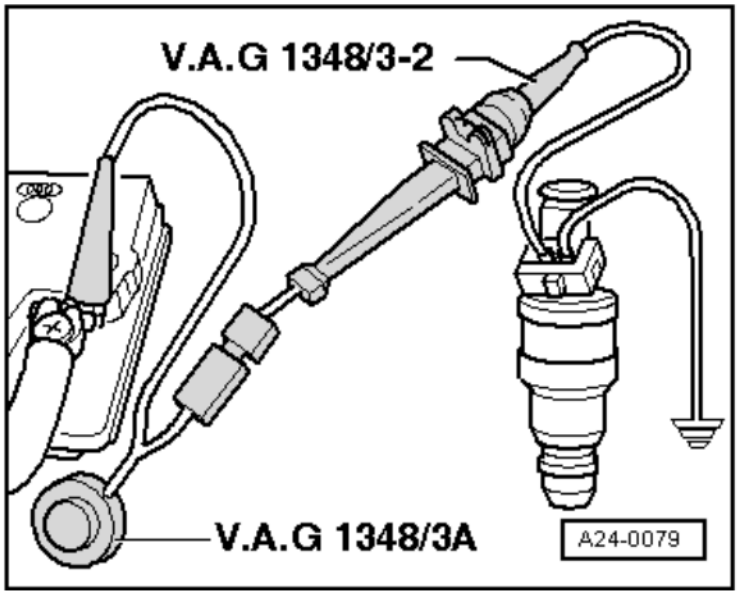

Fig. 172: Connecting One Injector Terminal To Engine Ground Using Test Lead And Alligator Clip From VAG1594 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect one injector terminal to engine Ground using a test lead and alligator clip from VAG1594 A.
- Connect second injector terminal to positive using remote control VAG1348/3A, adapter lead VAG1348/3-2 and auxiliary cable.
- Bridge terminals 1 and 65 at test box using leads from adapter kit VAG1594 A.
- Switch ignition on.

- The fuel pump should run.

- Activate remote control VAG1348/3 A for 30 seconds.
- When all three injectors of a cylinder bank have been activated, place three measuring glasses on a flat surface.

- Specification per injector: 90 to 125 ml

- If measured values for one or more injectors are outside tolerance range, stop fuel pump (switch off ignition) and replace faulty injector. Refer to **Fuel injectors, removing and installing**.
- Repeat test on injectors from second bank of cylinders.
- If measured values for all injectors are outside tolerance range, check fuel pressure. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**.

NOTE: When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

- Install injectors with fuel rail. Refer to **Installing**.

Fuel Pump (FP) relay -J17- and activation, checking

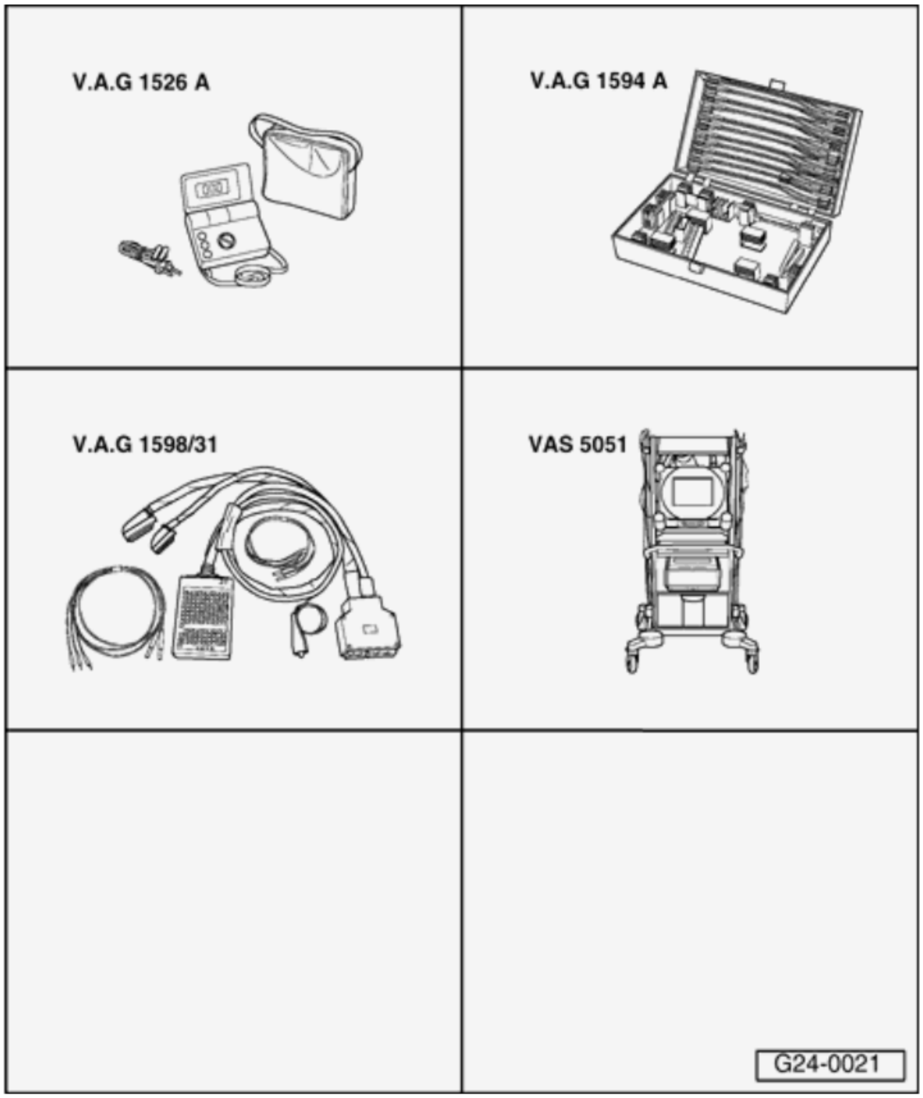

Fig. 173: Identifying Special Tools - Fuel Pump (FP) Relay -J17- And Activation, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

The fuel pump and certain components of the injection system are supplied with power by way of the Fuel Pump (FP) relay -J17-.

The Fuel Pump (FP) relay -J17- is only energized when the engine is running, i.e. the relay is only connected to

Ground (via the engine control module) when engine speed pulses are detected in the engine control module.

Test requirements

- Battery voltage at least 12.7 V

Functional check of fuel pump relay

- Remove driver's storage compartment:

Refer to

- **68 - INTERIOR EQUIPMENT**
- **68 - INTERIOR EQUIPMENT** for BODY INTERIOR - CABRIOLET

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 Engine electronics" in selection. Ignition must be switched on.
- Initiate final control diagnosis. Refer to **Output Diagnostic Test Mode (DTM)** and actuate Evaporative Emission (EVAP) canister purge regulator valve -N80-.

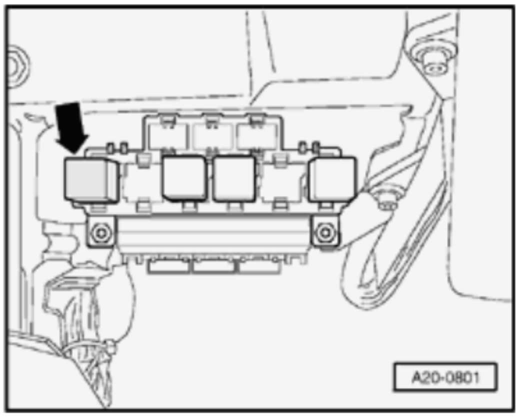

Fig. 174: Installed Location On 9-Socket Relay Carrier In Driver Footwell
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel pump relay (on the 9-unit-relay carrier in the driver's footwell on the left, position 1) should pull and fuel pump should run.

A - If relay does not respond:

- Check voltage supply of fuel pump relay. Refer to **Checking voltage supply of fuel pump relay**.
- Check activation of fuel pump relay. Refer to **Checking activation of fuel pump relay**.

B - If relay is energized but fuel pump does not run:

- Check voltage supply for fuel pump and components (via fuel pump relay). Refer to **Checking voltage supply of fuel pump and components**.

Checking voltage supply of fuel pump relay

- Disconnect fuel pump relay.

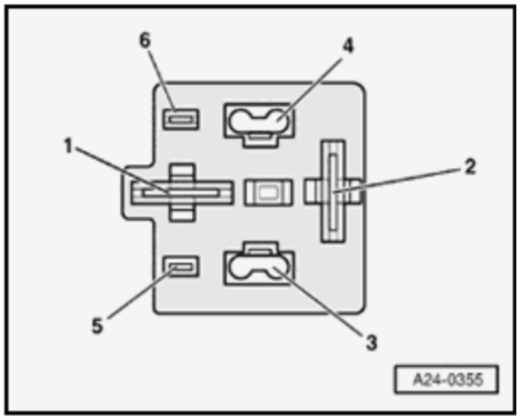

Fig. 175: Identifying Connector & 6 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage.

9-unit relay carrier in driver's footwell on left, position 1 Terminal	Measure to
1	Car body ground point

- Specified value: approx. battery voltage

- Connect multimeter as follows to measure voltage:

9-unit relay carrier in driver's footwell on left, position 1 Terminal	Measure to
3	Car body ground point

- Switch ignition on.

- Specified value: approx. battery voltage

If the specified values are not obtained:

- Check wiring connections.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If specifications are obtained:

Checking activation of fuel pump relay

- Switch ignition off.
- Reconnect relay.
- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Bridge terminals 1 and 65 at test box with leads from adapter kit VAG1594A.
- Switch ignition on.

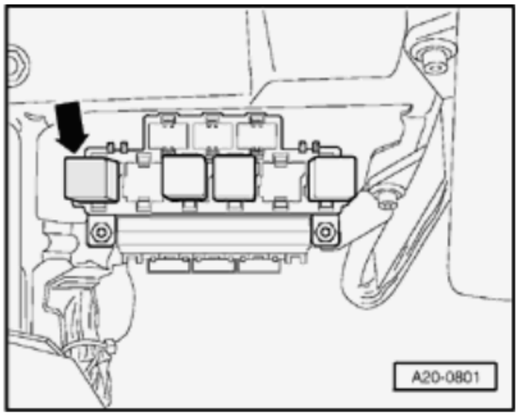

Fig. 176: Installed Location On 9-Socket Relay Carrier In Driver Footwell
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Fuel pump relay (on the 9-unit-relay carrier in the driver's footwell on the left, position 1) should pull and fuel pump should run.

If the relay responds now, but not during final control diagnosis:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

If the relay does not respond:

- Switch ignition off.
- Disconnect cable link.
- Disconnect fuel pump relay.

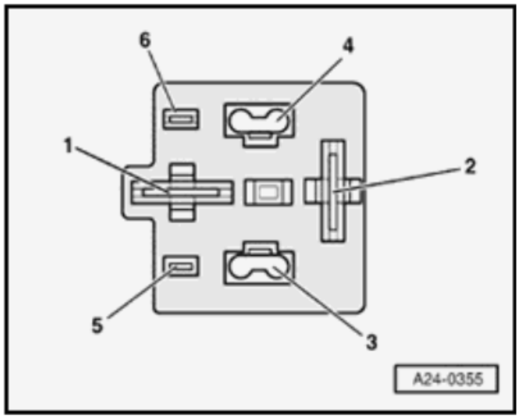

Fig. 177: Identifying Connector & 6 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connection:

9-unit relay carrier in driver's footwell on left, position 1 terminal	Test box VAG1598/31 Socket
5	65

- Repair any open/short circuit as necessary.

If no DTC is found:

- Replace Fuel Pump (FP) relay -J17-.
- Reconnect engine control module.

Checking voltage supply of fuel pump and components

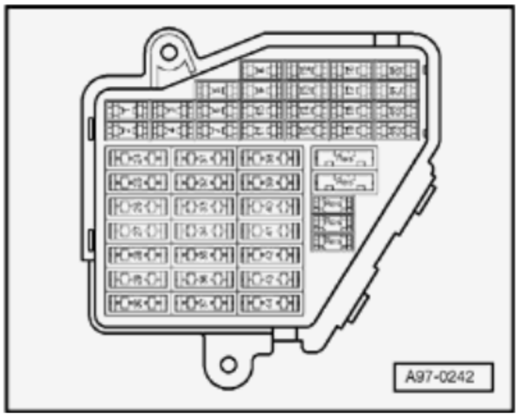

Fig. 178: Identifying Main Fuse Panel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect fuses S228, S229 and S234 (positions 28, 32 and 34) in fuse holder.
- Initiate final control diagnosis. Refer to **Output Diagnostic Test Mode (DTM)** and actuate evaporative

emission (EVAP) canister purge regulator valve -N80-.

- To measure voltage, connect multimeter to Ground and to one terminal of following fuses in fuse holder.

Fuse	Specified value at one of the terminals
S228	approx. battery voltage
S232	approx. battery voltage
S234	approx. battery voltage

If the specified values are not obtained:

- Repeat test at other terminal of fuse base.

If the specifications are still not obtained:

- Check wiring connections.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If no DTC is found:

- Replace fuel pump (FP) relay -J17-.
- Reinsert fuses.

Mass Air Flow (MAF) sensor -G70-, checking

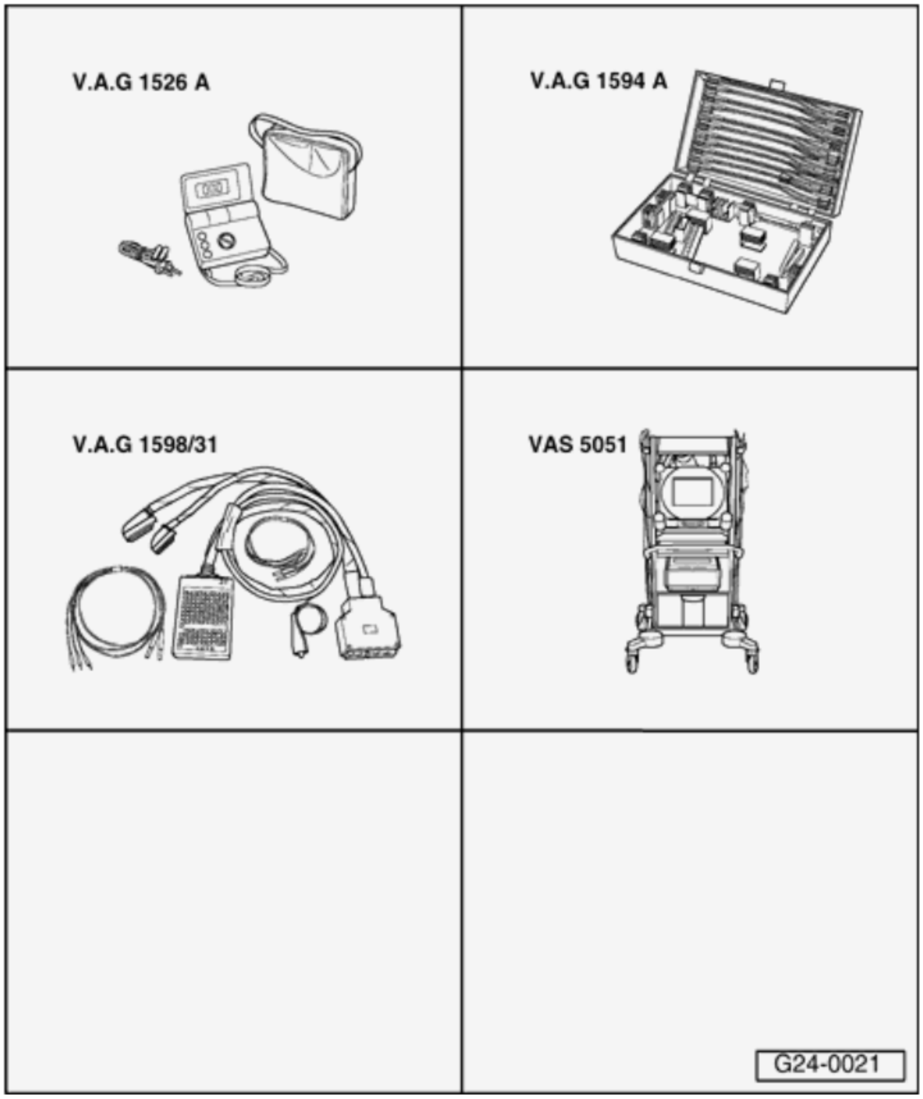

Fig. 179: Identifying Special Tools - Mass Air Flow (MAF) Sensor -G70-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

Location overview: Refer to **Component locations, overview**

Test requirements:

- Engine coolant temperature at least 80°C.

- Electrical accessories switched off (radiator fan must not run during the test).
- Air conditioning switched off.

Checking function

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Engine must be running at idling speed.

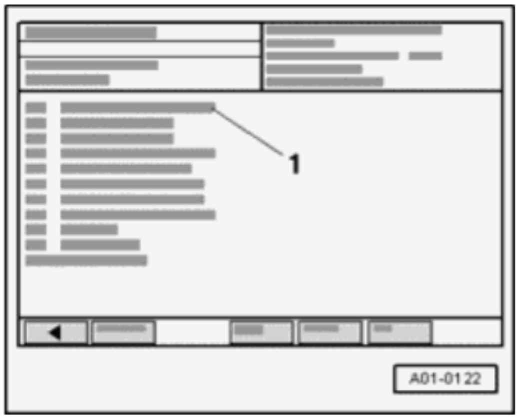

Fig. 180: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

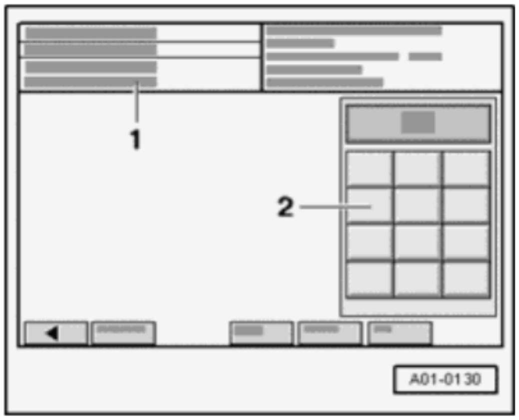

Fig. 181: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group max. input value = 255

- Enter "002" for "display group number 002" in zone -2- and confirm entry by pressing -Q- button.

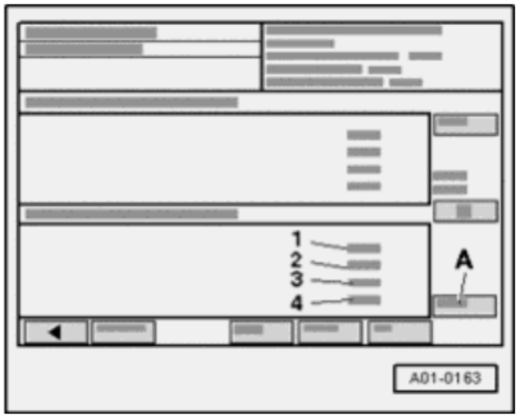

Fig. 182: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check specifications for load recognition in display zones -3- and -4-.

All models

	Display zones			
	1	2	3	4
Display group 002: Intake air mass at idle and operating temperature				
Display	xxx RPM	xxx %	**xx.x ms**	**xxx.x g/s**
Display	Engine speed	Load	**Average injection period**	**Air mass**
Specif. value	700 to 800 RPM	12.0 to 26.0%	**1.0 to 5.0 ms**	**1.0 to 5.0 g/s**
Note:	---	---	If specified value is not obtained: Evaluation. Refer to **Evaluation of display group 002**	

- Exit function "04 - Basic setting" by pressing <-- button.

Evaluation of display group 002

Display zone: 3	**Possible causes of malfunction**	**Corrective action**
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
Greater than 5.0 ms	- Engine load from accessories	- Eliminate load (air conditioner system/power

		steering/alternator)
	- Poor idling (not running on all cylinders)	○ Test spark plugs ○ Check injectors. Refer to **Fuel injectors, checking**
	- Throttle valve control module -J338- malfunction	○ Check throttle valve control module. Refer to **Throttle valve control module -J338-, checking**.
Display zone: 4	**Possible causes of malfunction**	**Corrective action**
Less than 1.0 g/s	- Large quantity of unmetered air between intake manifold and mass air flow (MAF) sensor - Voltage supply to mass air flow (MAF) sensor or wiring to engine control module	○ Check for leaks (unmetered air) in intake air system. Refer to **Intake air system for leaks (unmetered air), checking**. ○ Check voltage supply and/or wiring. Refer to **Testing voltage supply to mass air flow (MAF) sensor**
Greater than 5.0 g/s	- Engine load from accessories	○ Eliminate load (air conditioner system/power steering/alternator)
	- Voltage supply to mass air flow (MAF) sensor or wiring to engine control module	○ Check voltage supply and/or wiring. Refer to **Testing voltage supply to mass air flow (MAF) sensor**

Testing voltage supply to mass air flow (MAF) sensor

Test requirements:

- Fuse for mass air flow (MAF) sensor OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Fuel pump relay OK; checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**.

NOTE: Voltage supply to mass air flow (MAF) sensor is from fuel pump relay.

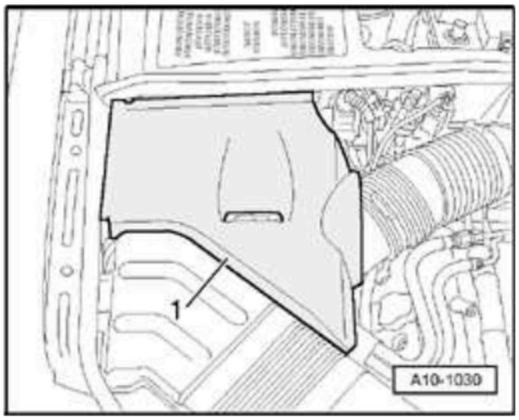

Fig. 183: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect cover -1- on right in engine compartment.

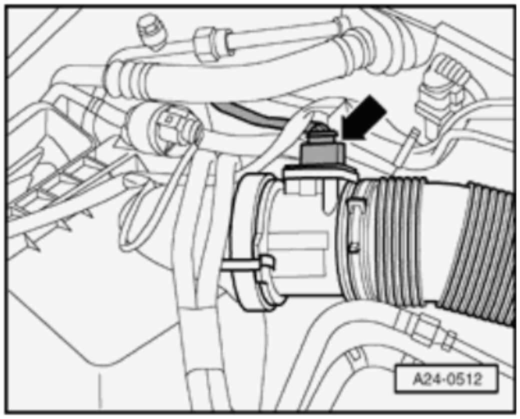

Fig. 184: Disconnecting Connector To Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector (arrow) to mass air flow (MAF) sensor.

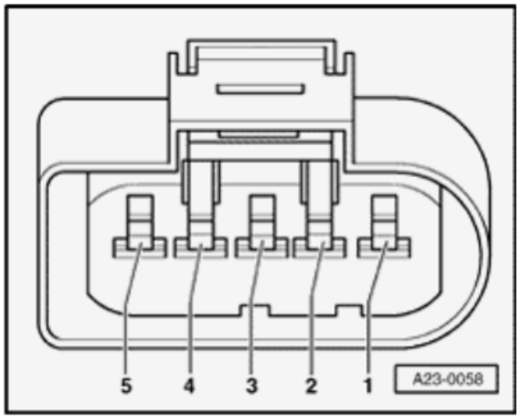

Fig. 185: Identifying 5-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage.

Connector Terminal	Measure to
2	Engine ground

- Operate starter briefly.

- Specified value: approx. battery voltage

If specified value is not obtained:

- Check wiring from terminal 2 on connector via fuse to fuel pump relay for open circuit or short to Ground:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair any open/short circuit as necessary.

If specified value is obtained:

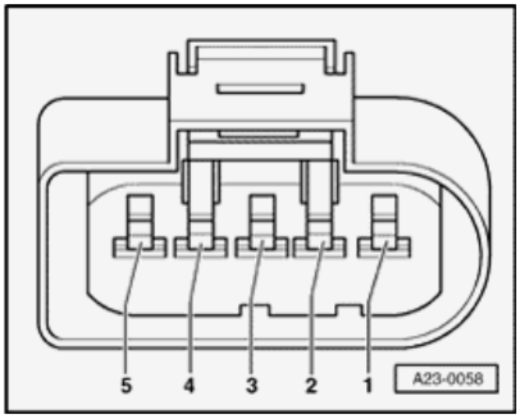

Fig. 186: Identifying 5-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 2 and 3 to measure voltage.
- Operate starter briefly (engine may start).

- Specified value: approx. battery voltage

NOTE: Engine control module Ground is present at terminal 3 of the connector.

If specified value is not obtained:

- Check wiring connections. Refer to **Checking wiring to mass air flow (MAF) sensor**.

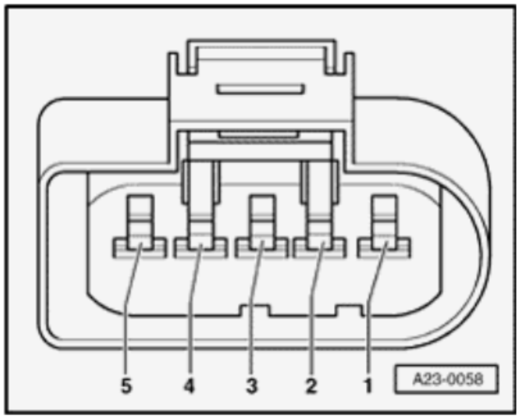

Fig. 187: Identifying 5-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 and 3 to measure voltage.

- Specified value: approx. 5 V

If specified value is not obtained:

Checking wiring to mass air flow (MAF) sensor

NOTE: The signal wire is also checked during the wiring check.

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

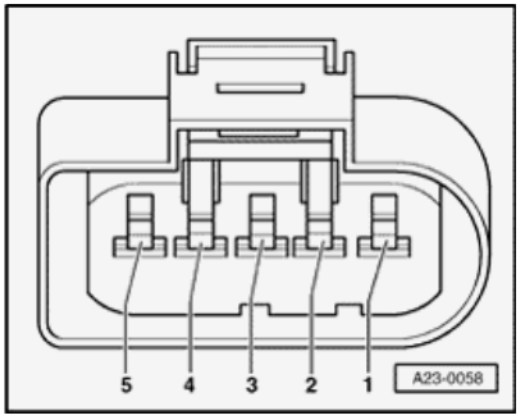

Fig. 188: Identifying 5-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket

1	53
3	27
4	29

- Repair any open/short circuit as necessary.
- Check all wires for short to one another.

If no wiring malfunction is detected:

- Replace mass air flow (MAF) sensor -G70-.

Intake air system for leaks (unmetered air), checking

Special tools and equipment

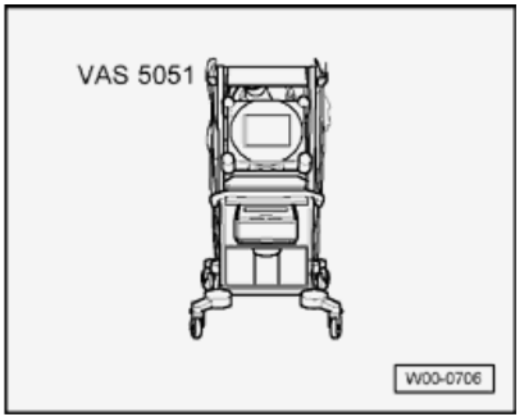

Fig. 189: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1
- Engine leak detector spray G 001 800 A1

NOTE:

- **The vacuum in the intake system will cause the leak detector spray to be drawn in with the unmetered air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.**
- **The safety precautions listed on the container must be adhered to.**

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Engine must be running at idling speed.

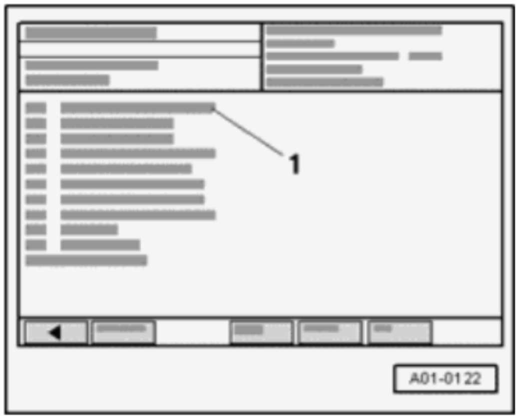

Fig. 190: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

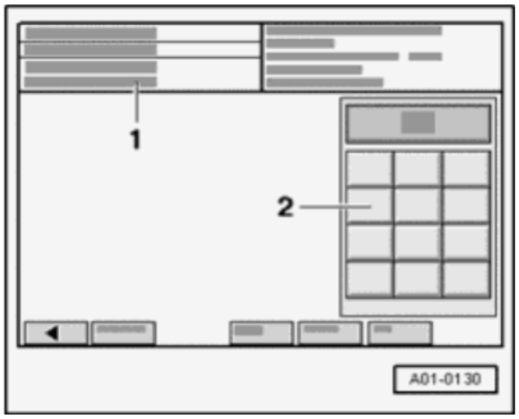

Fig. 191: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group max. input value = 255

- Enter "001" for "display group number 001" in zone -2- and confirm entry by pressing -Q- button.

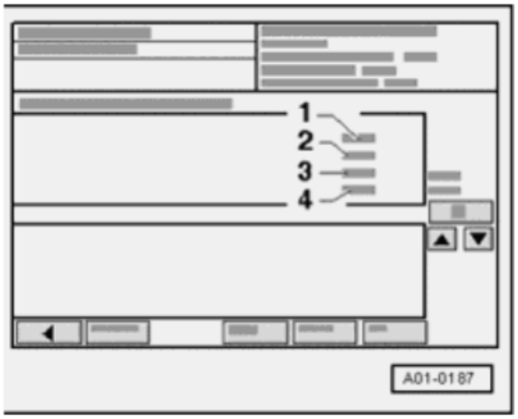

Fig. 192: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Note engine speed in display zone -1-.
- Systematically spray parts of intake system with engine leak detector spray.

If engine speed drops:

- Check sprayed areas of intake system for leaks and repair if necessary.
- Exit function "08 - Read measured value block" by pressing <-- button.

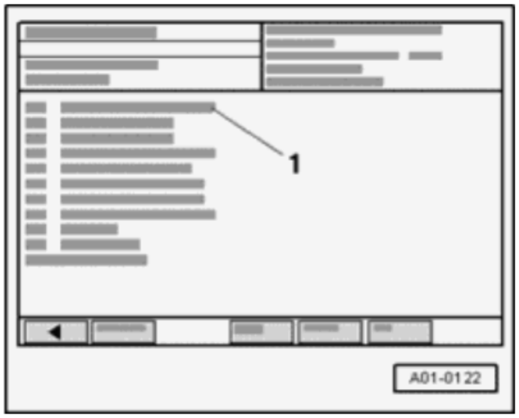

Fig. 193: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "06 - End output".
- Switch ignition off.

INTAKE MANIFOLD CHANGE-OVER, CHECKING

Intake manifold change-over, checking

Testing should only be performed if the engine is losing power.

The intake manifold change over function switches over from the long intake tract to the short intake tract at about 4200 RPM.

Intake manifold change-over, checking function

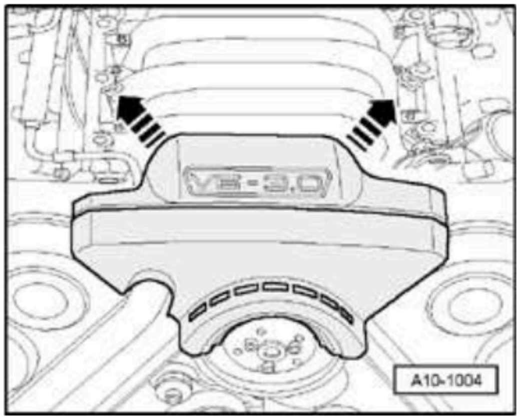

Fig. 194: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).
- Start engine and increase engine speed to well above 4200 RPM.

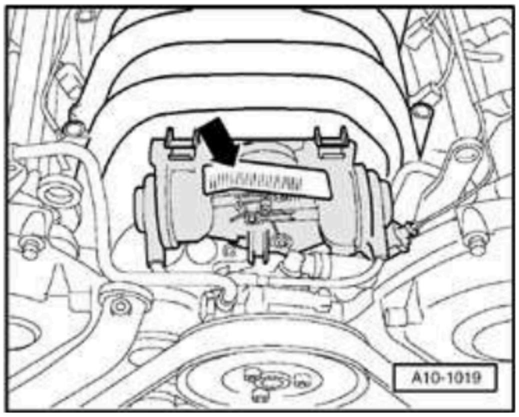

Fig. 195: Identifying Operating Rods Of Actuator For Intake Manifold
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The operating rods of the actuator for the intake manifold (arrow) must move

If the change-over is not taking place, perform the following tests:

- Check intake manifold change-over valve -N156- (perform final control diagnosis. Refer to **Output Diagnostic Test Mode (DTM)**, if necessary, check valve and actuation. Refer to **Intake manifold**

change-over valve -N156-, checking or **Checking actuation**).

- Checking vacuum system for leaks. Refer to **Vacuum system, checking for leaks**.
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that change-over mechanism operates freely (move push rod by hand).

Vacuum system, checking for leaks

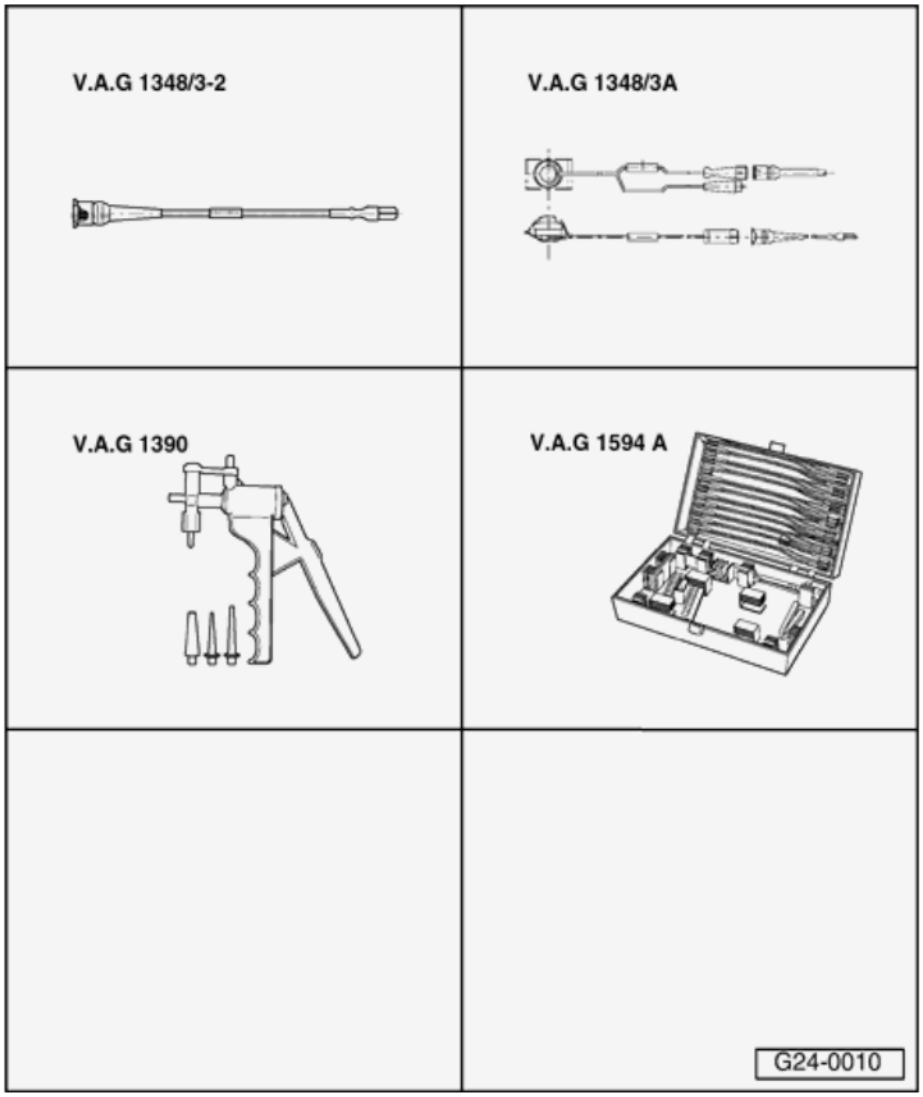

Fig. 196: Identifying Special Tools - Vacuum System, Checking For Leaks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1348/3-2
- VAG1348/3A
- VAG1390

- VAG1594 A

Test sequence

- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch ignition off.

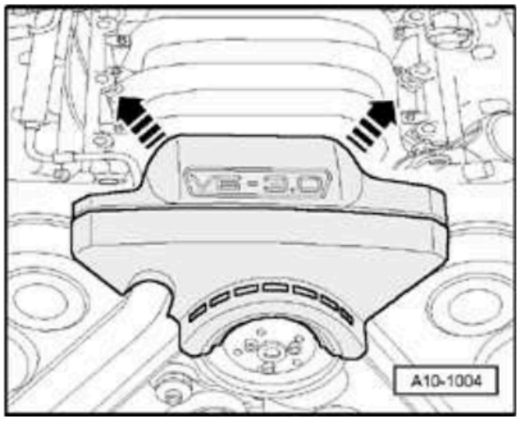

Fig. 197: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

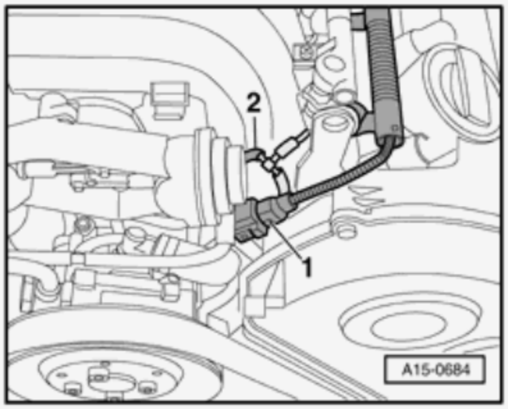

Fig. 198: Disconnecting Electrical Harness Connector & Pulling Off Vacuum Hose At T-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors to intake manifold change-over valve -N156- -1-.

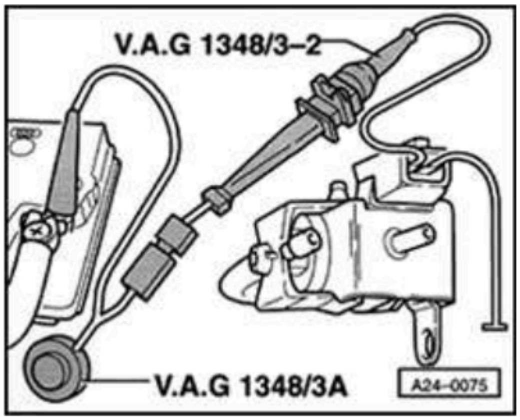

Fig. 199: Connecting One Terminal On Solenoid Valve To Engine Ground Using Test Leads And Alligator Clamp From VAG1594 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect one terminal on solenoid valve to engine Ground using test leads and alligator clamp from VAG1594 A.
- Connect second terminal on intake manifold change-over valve -N156- to positive using remote control VAG1348/3A, adapter lead VAG1348/3-2 and auxiliary cable.
- Operate remote control VAG1348/3A approx. 2 to 3 minutes; throughout this period, vacuum module should remain energized.

If the vacuum module retardations to its original "rest" position, perform the following test:

- Disconnect vacuum hoses from vacuum module for intake manifold change-over system.
- Connect hand vacuum pump VAG1390 to vacuum module.
- Operate hand pump and check whether change-over function is working.
- Check vacuum module for leaks. (Vacuum module should not return to rest position until hand pump is vented to atmosphere.)

- Replace vacuum module, if necessary.
- If vacuum module is not energized, check intake manifold change-over valve -N156- as follows for blockage:

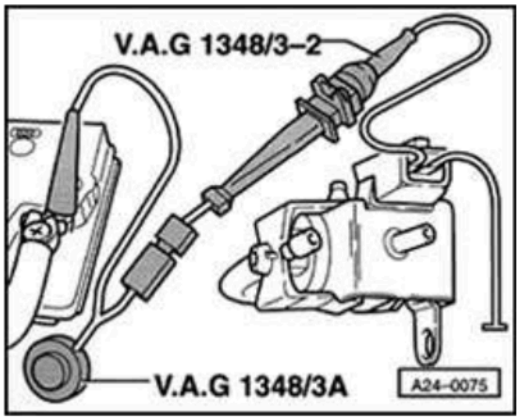

Fig. 200: Connecting One Terminal Of Intake Manifold Change-Over Valve -N156- To Engine Ground Using Test Leads And Alligator Clamp From VAG1594 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect one terminal of intake manifold change-over valve -N156- to engine Ground using test leads and alligator clamp from VAG1594 A.
- Connect second terminal on intake manifold change-over valve -N156- to positive using remote control VAG1348/3A, adapter lead VAG1348/3-2 and auxiliary cable.
- Operate remote control VAG1348/3A.
- Check valve for obstructions (disconnect vacuum hoses and blow through).

- Replace intake manifold change-over valve, if necessary.
- If no DTCs have been found in any test, check vacuum system for leaks.

Intake manifold change-over valve -N156-, checking

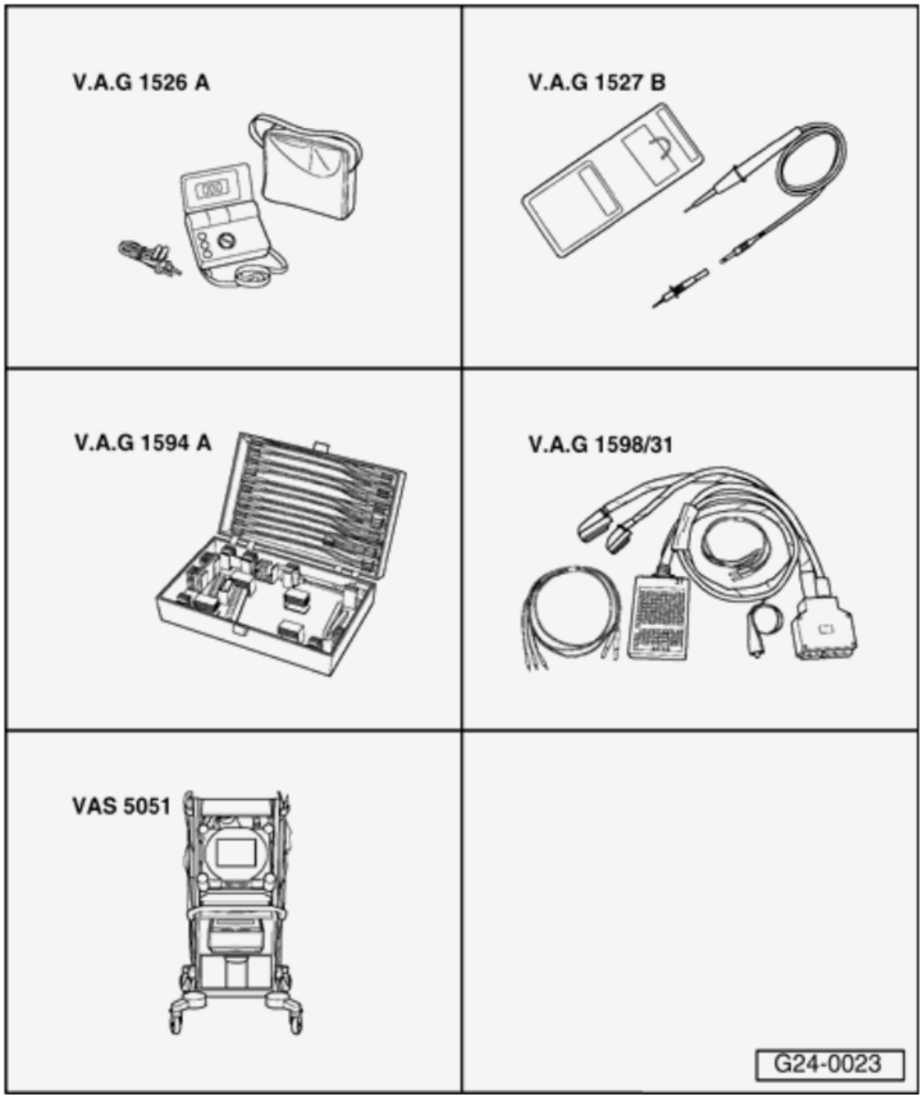

Fig. 201: Identifying Special Tools - Intake Manifold Change-Over Valve -N156-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

- VAS5051 with VAS5051/1

Test sequence

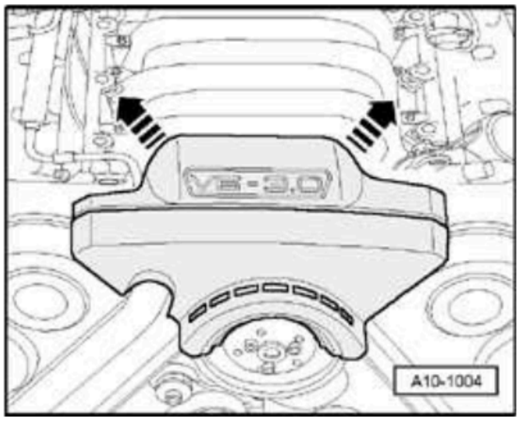

Fig. 202: Removing Front Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove front engine cover (arrows).

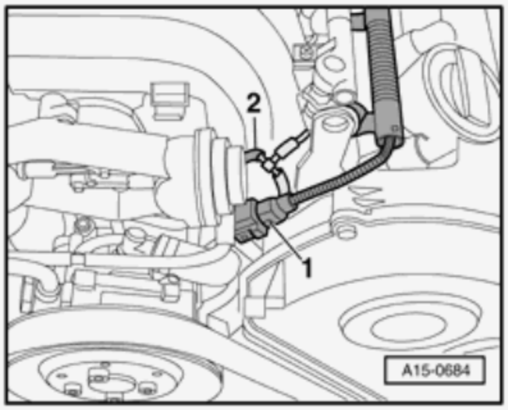

Fig. 203: Disconnecting Electrical Harness Connector & Pulling Off Vacuum Hose At T-Connector
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors to intake manifold change-over valve -N156- -pos. -1-.

Checking internal resistance

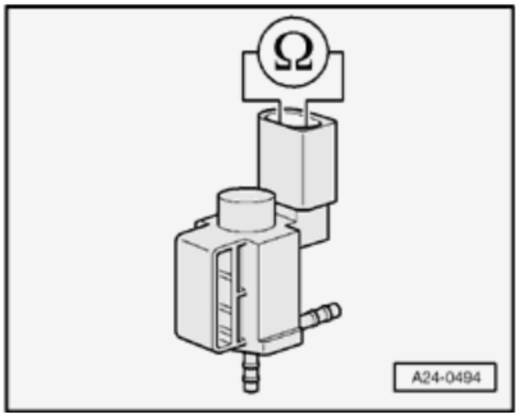

Fig. 204: Checking Injector Internal Resistance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter to injector to measure resistance.

- Specified value: 25 to 35 ohms

If specified value is not obtained:

- Replace intake manifold change-over valve -N156-.

If specified value is obtained:

Checking power supply

Test requirements

- Fuse for intake manifold change-over valve OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Fuel pump relay OK; checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**.

NOTE: Power supply of the intake manifold change-over valve is via the fuel pump relay.

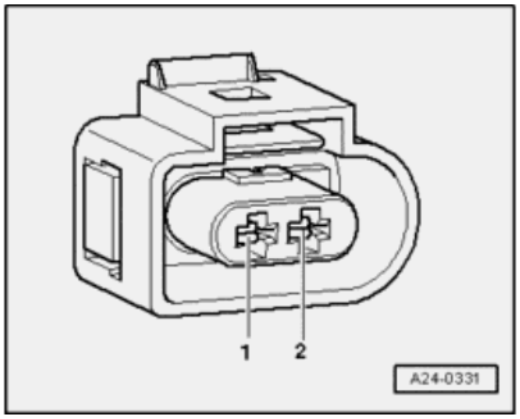

Fig. 205: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B as follows:

Connector Terminal	Measure to
1	Engine ground

- Operate starter briefly.

- LED should illuminate.

If the LED does not illuminate:

- Check wiring from terminal 1 on connector via fuse to fuel pump relay for an open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit if necessary.

If LED lights up:

Checking actuation

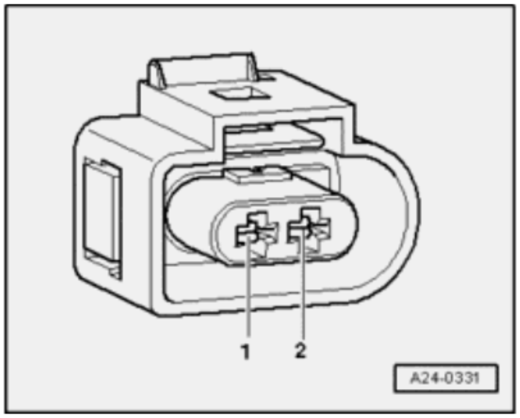

Fig. 206: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B between terminals 1 and 2.
- Initiate final control diagnosis. Refer to **Output Diagnostic Test Mode (DTM)** and activate intake manifold change-over valve.

- LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- Connect test box VAG1598/31 to wiring harness for engine control module; engine control module must not be connected. Refer to **Wiring and component check with test box VAG 1598/31**.
- Check for open circuit and short to positive or Ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
2	48

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

OXYGEN SENSOR CONTROL, CHECKING

Oxygen sensors and oxygen sensor control before catalytic converter, checking

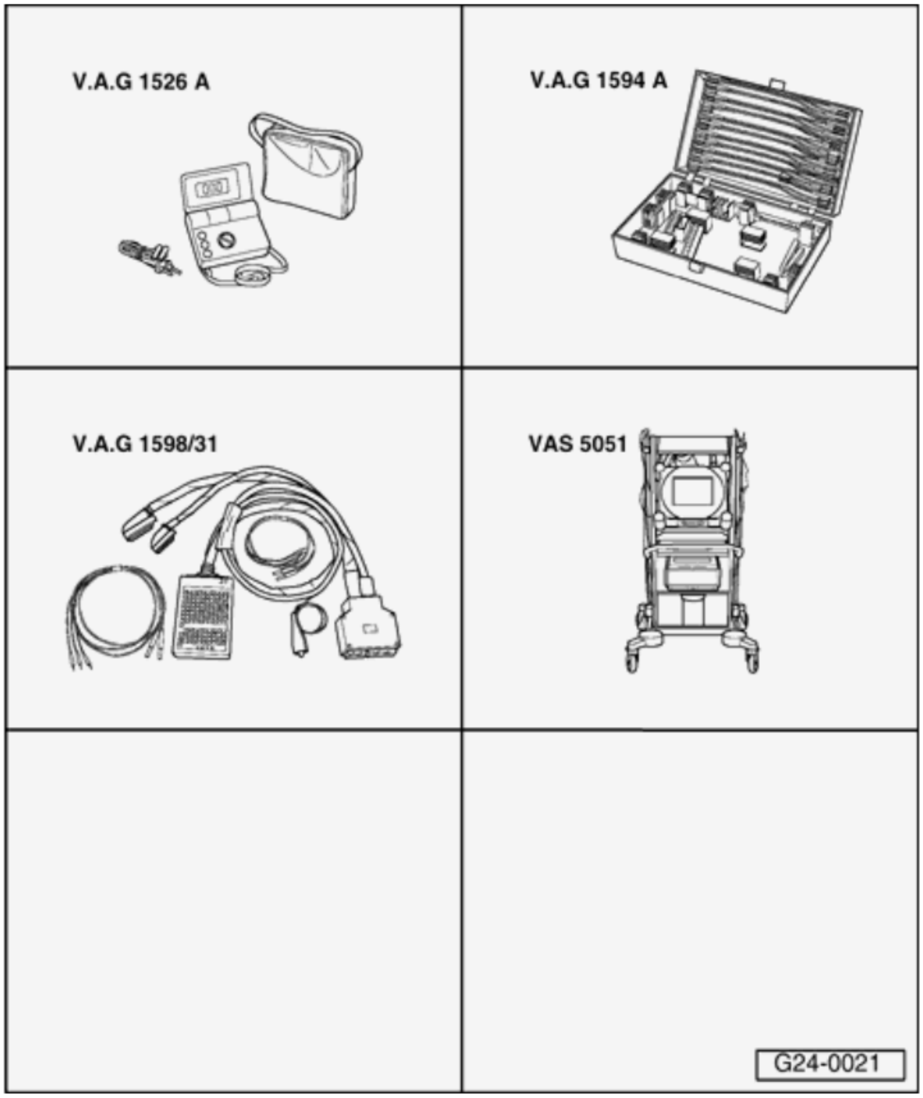

Fig. 207: Identifying Special Tools - Oxygen Sensors And Oxygen Sensor Control Before Catalytic Converter, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

Test requirements

- No leaks in exhaust system
- Engine coolant temperature at least 80°C. Refer to display group 004, display zone 3.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Engine must be running at idling speed.

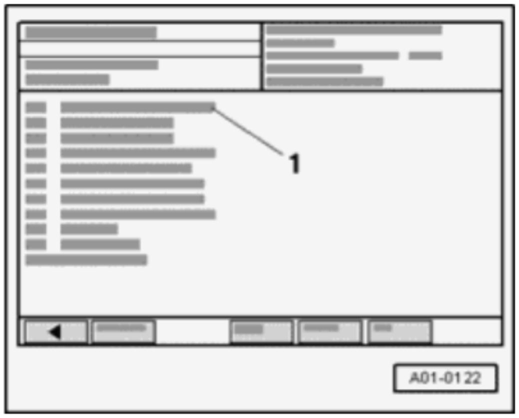

Fig. 208: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

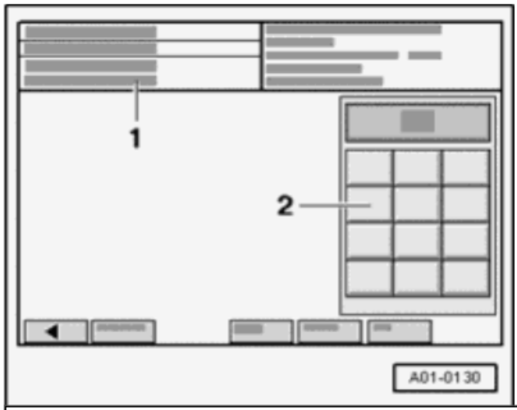

Fig. 209: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "030" for "display group number 030" in zone -2- and confirm entry by pressing -Q- button.

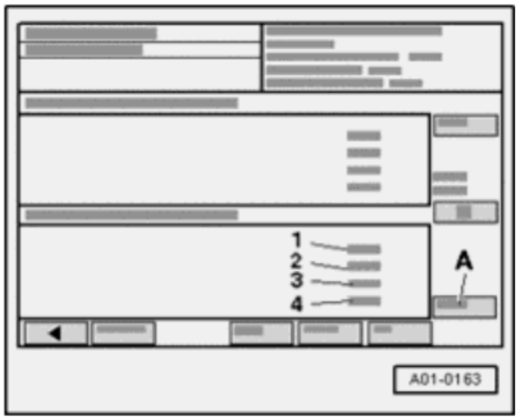

Fig. 210: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check specifications in display zones -1- and -3-.

NOTE:

- **By increasing the engine speed the specified values are achieved quickly.**
- **The "oxygen sensor status" indicates the condition of the oxygen sensor control and the oxygen sensors.**

	Display zones			
	1	2	3	4
Display group 030: Oxygen sensor status				
Display	**X X X**	X X X	**X X X**	X X X
Display	**Oxygen sensor status, Bank 1, sensor 1**	Oxygen sensor status, Bank 1, sensor 2	**Oxygen sensor status, Bank 2, sensor 1**	Oxygen sensor status, Bank 2, sensor 2
Range	**0 = off** **1 = on**	0 = off 1 = on	**0 = off** **1 = on**	0 = off 1 = on
Specif. value	**1 1 1**	1 1 0	**1 1 1**	1 1 0
Note:	If the specification is not obtained. Refer to **Checking basic voltage** If specified value obtained but DTC stored in DTC memory. Refer to **Checking oxygen sensor learned values and oxygen sensor control**			

Significance of 3-digit readout of display group 030			
X	X	X	**Display zones 1...4**
X			Condition of oxygen sensor heating: 0 = not active; 1 = active
	X		Oxygen sensor condition: 0 = not active; 1 = active
		X	Oxygen sensor control 0 = not active; 1 = active

NOTE: The first digit of the 3-digit display (heating) fluctuates between 0 and 1.

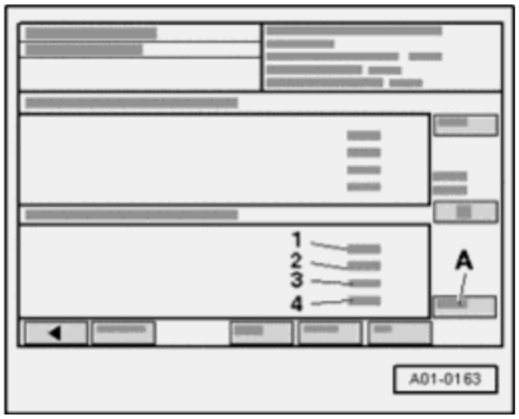

Fig. 211: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Only continue with test if displays have reached "111" in display zones -1- and -3- at least once.
- Press <-- button.

Checking oxygen sensor learned values and oxygen sensor control

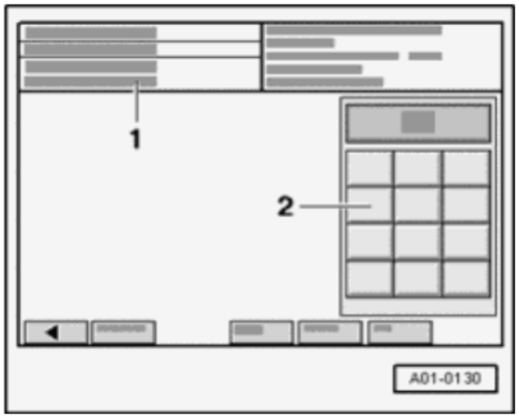

Fig. 212: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "032" for "display group number 032" in zone -2- and confirm entry by pressing -Q- button.
- Check values in display zones -1- to -4-.

	Display zones			
	1	2	3	4
Display group 032: Oxygen sensor learned values before catalytic converter				
Display	**xx.x%**	**xx.x%**	**xx.x%**	**xx.x%**
Display	**Oxygen sensor learned value Bank 1 at idle (additive)**	**Oxygen sensor learned value, Bank 1, at part load (multiplicative)**	**Oxygen sensor learned value Bank 2 at idle (additive)**	Oxygen sensor learned value Bank 2 at part load (multiplicative)
Specif. value	**-4.0 to 4.0%**	**-10.0 to 10.0%**	**-4.0 to 4.0%**	**-10.0 to 10.0%**
Note:	If the specification is not obtained. Refer to **Evaluating display group 032**			

- Press <-- button.

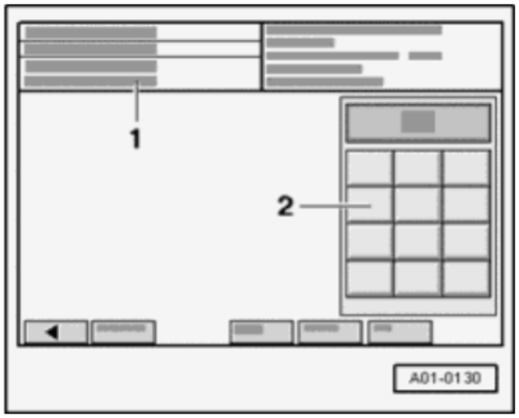

Fig. 213: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "033" for "display group number 033" in zone -2- and confirm entry by pressing -Q- button.

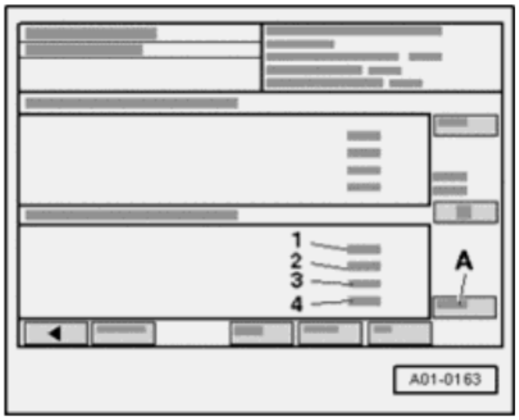

Fig. 214: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check indication in display fields -1- to -4-.

	1	2	3	4
Display group 033: Oxygen sensor control before catalytic converter				
Display	**xx.x%**	**x.xxx V**	**xx.x%**	**x.xxx V**
Display	**Oxygen sensor control Bank 1, sensor 1**	**Oxygen sensor voltage Bank 1, sensor 1**	**Oxygen sensor control Bank 1, sensor 2**	**Oxygen sensor voltage Bank 1, sensor 2**
Specif. value	**In range -10.0 to 10.0% value must fluctuate at least 2%**	**1.400 to 1.600 V**	**In range -10.0 to 10.0% value must fluctuate at least 2%**	**1.400 to 1.600 V**
Note:	If specified value is not obtained Continuation. Refer to **Checking oxygen sensor learned values and oxygen sensor control**	If specified value is not achieved Evaluation display group 033: Refer to **Evaluating display group 033**	If specified value is not obtained Continuation. Refer to **Checking oxygen sensor learned values and oxygen sensor control**	If specified value is not achieved Evaluation display group 033: Refer to **Evaluating display group 033**

Note on display zones 2 and 4:

Displayed is the oxygen sensor voltage signal which was prepared and smoothed in the engine control module. 1.5 V in the display corresponds to oxygen sensor 1 (with the engine at operating temperature without secondary air system influence).

- Exit function "04 - Basic setting" by pressing <-- button.

(cont.)

If specification is not obtained in display zone 1 or display zone 3, or if the value does not fluctuate by at least 2%:

- Perform drive test to free oxygen sensors from any possible residues and repeat test.

If the specified result is not achieved in display zones 1 or 3, or if the value does not fluctuate by at least 2%, even after the test drive:

- Check basic voltage. Refer to **Checking basic voltage**.
- Check oxygen sensor heating before catalytic converter. Refer to **Oxygen sensors before catalytic converter, checking heating**.
- Check oxygen sensor before catalytic converter for aging. Refer to **Oxygen sensors before catalytic converter, checking aging**.

Evaluating display group 032

Display zone: 1/3 or 2/4	Possible causes of malfunction	Corrective action
Oxygen sensor learned Values below specified range	• Oil dilution	○ Perform oil change or drive vehicle fairly fast on out-of-town roads
	• High oil consumption	
	• Mass air flow (MAF) sensor faulty	○ Test mass air flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking**.
	• Evaporative emission (EVAP) canister purge regulator valve stuck open	○ Check Evaporative Emission (EVAP) canister purge regulator valve. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking**.
	• Fuel pressure too high	○ Check fuel system pressure. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**
	• Injector not closing	○ Check injectors. Refer to **Fuel injectors, checking**
	• Oxygen sensor heating faulty	○ Check oxygen sensor heating. Refer to **Oxygen**

	• Oxygen sensor faulty	**sensors before catalytic converter, checking heating**.

Evaluating display group 032

Display zone: **1/3 or 2/4**	**Possible causes of malfunction**	**Corrective action**
Oxygen sensor learned values above specified range	• Unmetered air in intake area	○ Check intake system for leaks and correct unmetered air. Refer to **Intake air system for leaks (unmetered air), checking**
	• Fuel pressure too low	○ Check fuel system pressure. Refer to **Fuel pressure regulator and holding pressure (vehicles up to 06.03), checking**
	• Mass air flow (MAF) sensor faulty	○ Test mass air flow (MAF) sensor. Refer to **Mass Air Flow (MAF) sensor -G70-, checking**
	• Oxygen sensor heating faulty • Oxygen sensor faulty	○ Check oxygen sensor heating. Refer to **Oxygen sensors before catalytic converter, checking heating**
	• Injector only opens partially or not at all	○ Check injectors. Refer to **Fuel injectors, checking**
	• Evaporative emission (EVAP) canister purge regulator valve sticking	○ Check EVAP canister purge regulator valve. Refer to **Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking**

Evaluating display group 033

Display zone: 2/4	**Possible causes of malfunction**	**Corrective action**
Greater than 4.800 V	• Short to positive in wiring between oxygen sensor and control module • Oxygen sensor faulty	○ Check wiring of oxygen sensors before catalytic converter. Refer to **Oxygen sensors and oxygen sensor control before catalytic converter, checking**

Less than 0.130 V	• Short to Ground in wiring between oxygen sensor and control module • Oxygen sensor faulty	○ Replace oxygen sensor before catalytic converter

Checking basic voltage

Test requirements:

- Fuse for oxygen sensors OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Disconnect 6-pin connector of relevant oxygen sensor before catalytic converter. See **Fig. 101** and **Fig. 102**.

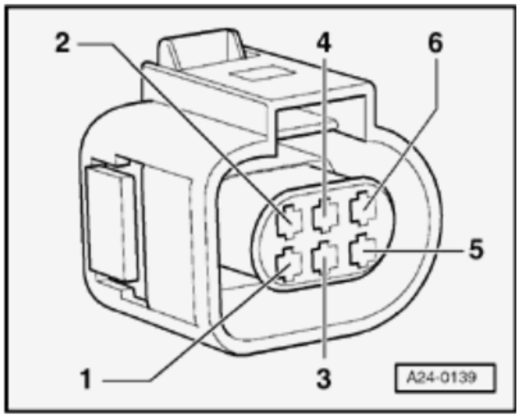

Fig. 215: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 and 5 to measure voltage.
- Switch ignition on.

- Specified value: 0.400 to 0.500 V

- Switch ignition off.

If specified value is not obtained:

- Check oxygen sensor wiring:

Bank 1. Refer to **Check oxygen sensor wiring, bank 1, sensor 1, Heated Oxygen Sensor (HO2S) -G39-** or Bank 2 **Check oxygen sensor wiring, bank 2, sensor 1, Heated Oxygen Sensor (HO2S) 2 -G108-**

If specified value is obtained:

- Replace relevant oxygen sensor before catalytic converter.

Check oxygen sensor wiring, bank 1, sensor 1, Heated Oxygen Sensor (HO2S) -G39-

- Disconnect 6-pin connector of bank 1, Heated Oxygen Sensor (HO2S) -G39-. See **Fig. 101**.
- Connect test box VAG1598/31 to wiring harness for engine control module; engine control module must not be connected. Refer to **Wiring and component check with test box VAG 1598/31**.

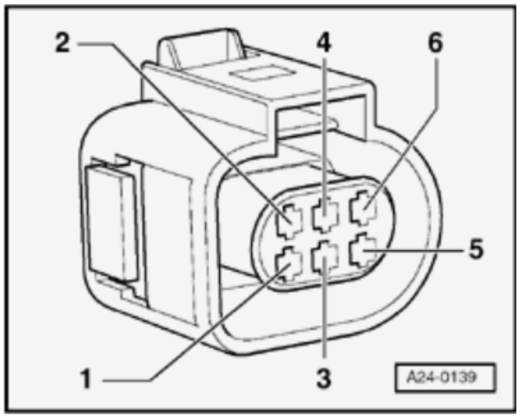

Fig. 216: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit in following wiring connections.

Connector Terminal	Test box VAG1598/31 Socket
1	70
2	71
5	51
6	52

- Repair open circuit, if necessary.
- Check for shorts between two wires.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Check oxygen sensor wiring, bank 2, sensor 1, Heated Oxygen Sensor (HO2S) 2 -G108-

- Disconnect 6-pin connector of bank 2, Heated Oxygen Sensor (HO2S) 2 -G108-. See **Fig. 102**.
- Connect test box VAG1598/31 to wiring harness for engine control module; engine control module must not be connected. Refer to **Wiring and component check with test box VAG 1598/31**.

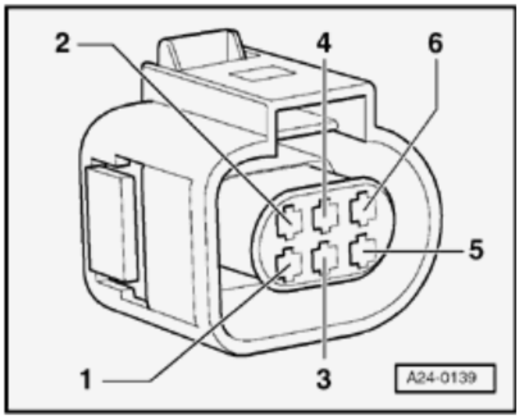

Fig. 217: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit in following wiring connections.

Connector Terminal	Test box VAG1598/31 Socket
1	13
2	14
5	12
6	15

- Repair open circuit, if necessary.
- Check for shorts between two wires.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Oxygen sensors before catalytic converter, checking aging

Special tools and equipment

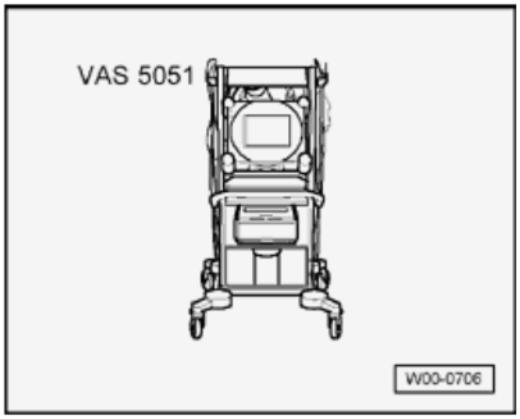

Fig. 218: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Test requirements:

- Engine coolant temperature at least 80°C. Refer to display group 004, display zone 3.

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

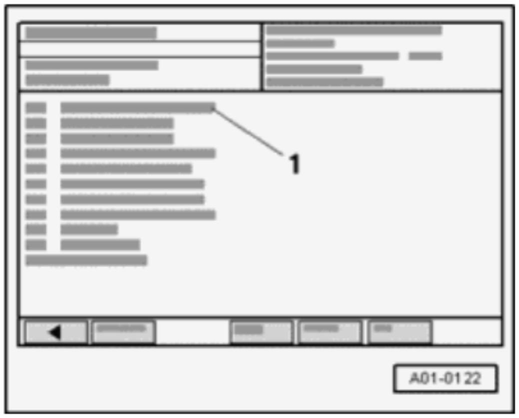

Fig. 219: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

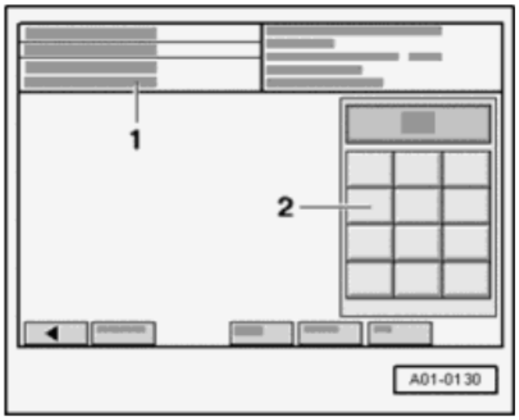

Fig. 220: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Select function "197" in button field -2- for "display group number 197" and press -Q- button to confirm input.

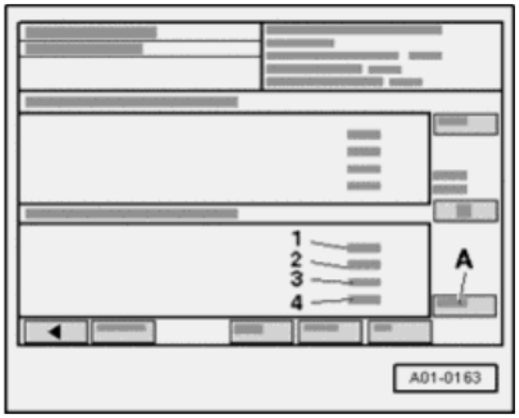

Fig. 221: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Press accelerator and brake pedal simultaneously, engine speed increases to approx. 2200 RPM.

Test conditions:

- Accelerator and brake pedal pressed simultaneously, engine runs at approx. 2200 RPM.

- Check specifications in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display 197: Diagnosis of oxygen sensor aging (Bank 1, sensor 1 - Bank 2, sensor 1)				
Display	x.x	---	**x.x**	**---**
Display	Dynamics factor Bank 1, sensor 1	Diagnosis status	Dynamics factor Bank 2, sensor 1	Diagnosis status
Range		**Test OFF** **Test ON** **B1-S1 OK** **B1-PS1 NOK**		**Test OFF** **Test ON** **B1-S1 OK** **B1-S1 NOK**
Specified value	0.6 to 2.5	B1-PS1 NOK	**0.6 to 2.5**	B1-S1 NOK
Note:	If specification not obtained. Refer to **Oxygen sensors before catalytic converter, checking aging**			

Note on display zones 1 and 3:

The dynamics factor is the characteristic for the aging of the oxygen sensor. The lower the dynamics factor the more advanced is the aging of the oxygen sensor.

- Press <-- button.

(cont.)

If specification in display zone 3 or 4 is not obtained:

- Perform test drive to free oxygen sensors from any possible residues and repeat test.

If specified value in display zone 3 or 4 is not obtained, after a test drive has been performed:

- Replace relevant oxygen sensor before catalytic converter.

Oxygen sensors before catalytic converter, checking heating

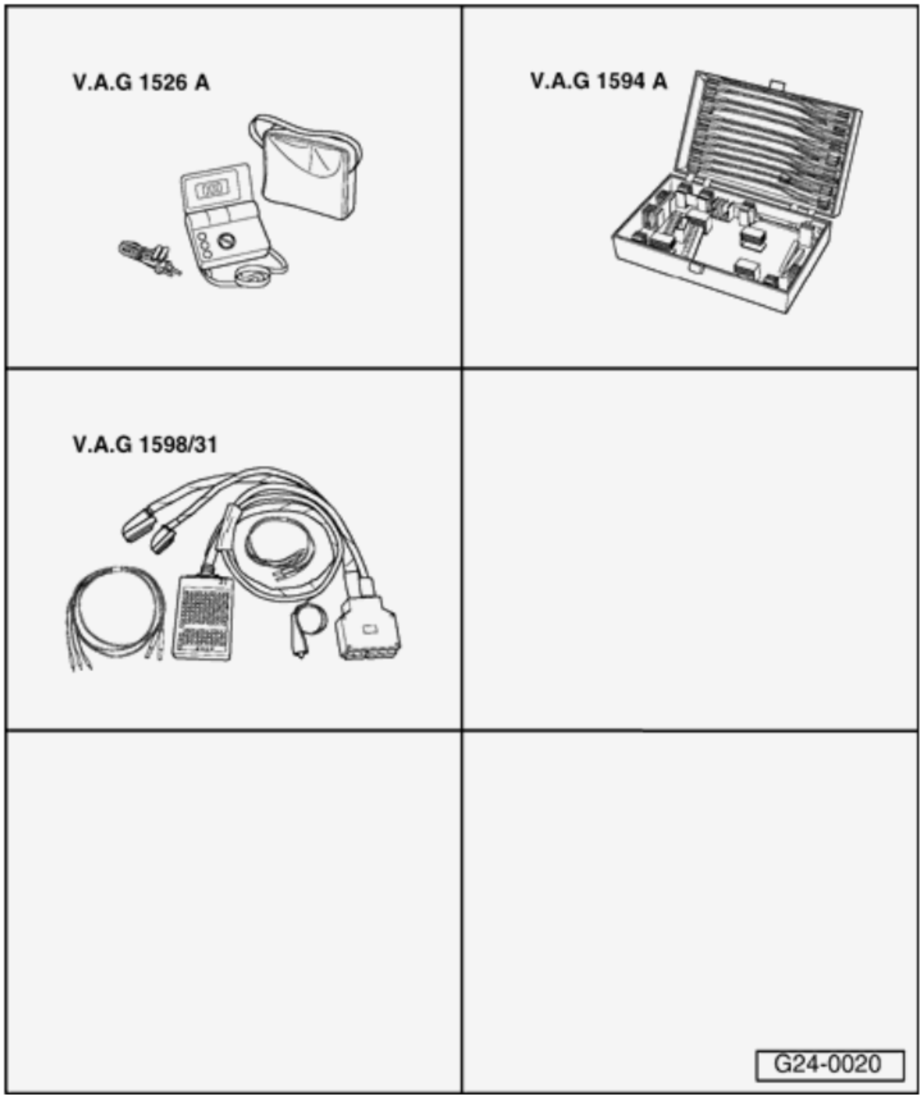

Fig. 222: Identifying Special Tools - Oxygen Sensors Before Catalytic Converter, Checking Heating
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31

Test requirements

- Fuse for oxygen sensor heating OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Test sequence

- Disconnect 6-pin connector of bank 1, Heated Oxygen Sensor (HO2S) -G39-. See **Fig. 101**.

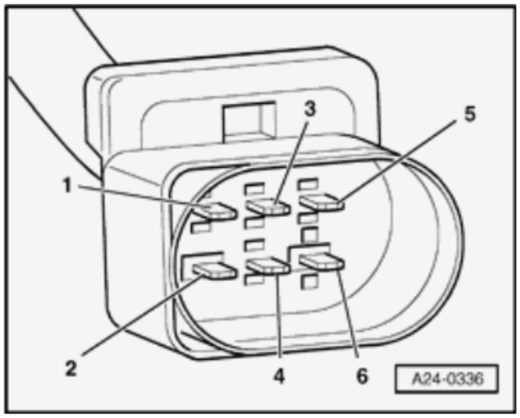

Fig. 223: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 3 and 4 to measure resistance.

- Specified value at room temperature 2.5 to 10 ohms

If specified value is not obtained:

- Replace HO2S -G39-.

If specified value is obtained:

Check voltage supply for oxygen sensor heating

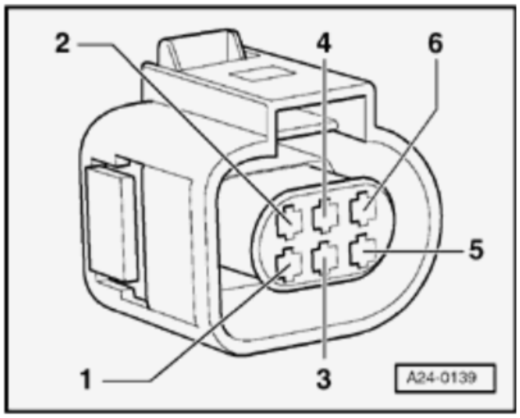

Fig. 224: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 3 and 4 to measure voltage.
- Start engine.

- Specified value: approx. battery voltage

NOTE: Points at which oxygen sensor heating is switched on and off by engine control module can be observed in "Reading measured value block" function, display group number 041 and display zone 2.

If no voltage is present:

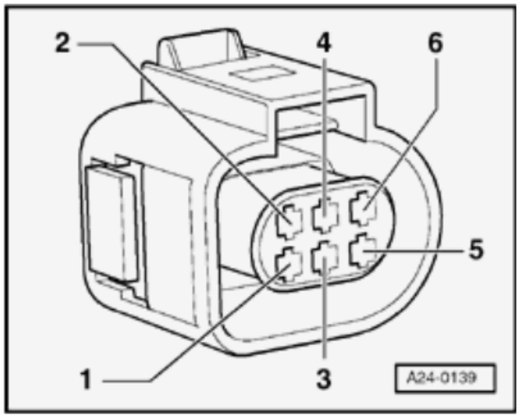

Fig. 225: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage.

Connector Terminal	Measure to
3	Engine ground

- Operate starter briefly.

- Specified value: approx. battery voltage

If no voltage is present:

- Check wiring from terminal 3 on connector via fuse to fuel pump relay for an open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If voltage supply is OK:

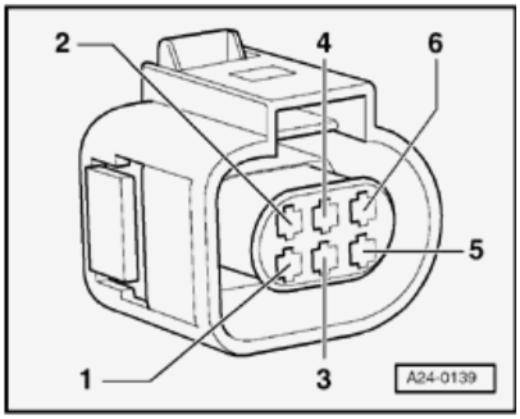

Fig. 226: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Measure to
4 (Ground actuation by engine control module)	Battery positive

- Start engine.

- Specified value: approx. battery voltage

NOTE: Points at which oxygen sensor heating is switched on and off by engine control module can be observed in "Reading measured value block" function, display group number 041 and display zone 2.

- Switch ignition off.

If no voltage is present:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

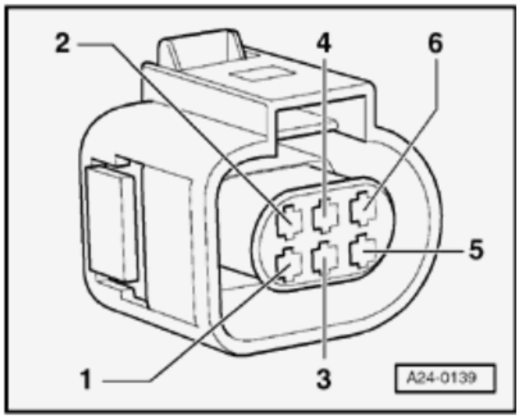

Fig. 227: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
4	5

- Repair open circuit, if necessary.

If wiring is OK but there is no Ground supply for the oxygen sensor heating:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Oxygen sensors and oxygen sensor control behind catalytic converter, checking

NOTE: **The oxygen sensor before catalytic converter (bank 1, sensor 1 and bank 2, sensor 1) regulates to oxygen sensor 1. If this oxygen sensor is damaged, e.g. due to dirt or overheating, the regulation value may have shifted. Deviations from oxygen sensor 1 are detected by the oxygen sensor behind catalytic converter (bank 1, sensor 2 and bank 2, sensor 2). If it recognizes the deviations downward or upward, it influences the regulation before catalytic converter, generally increasing or decreasing it respectively.**

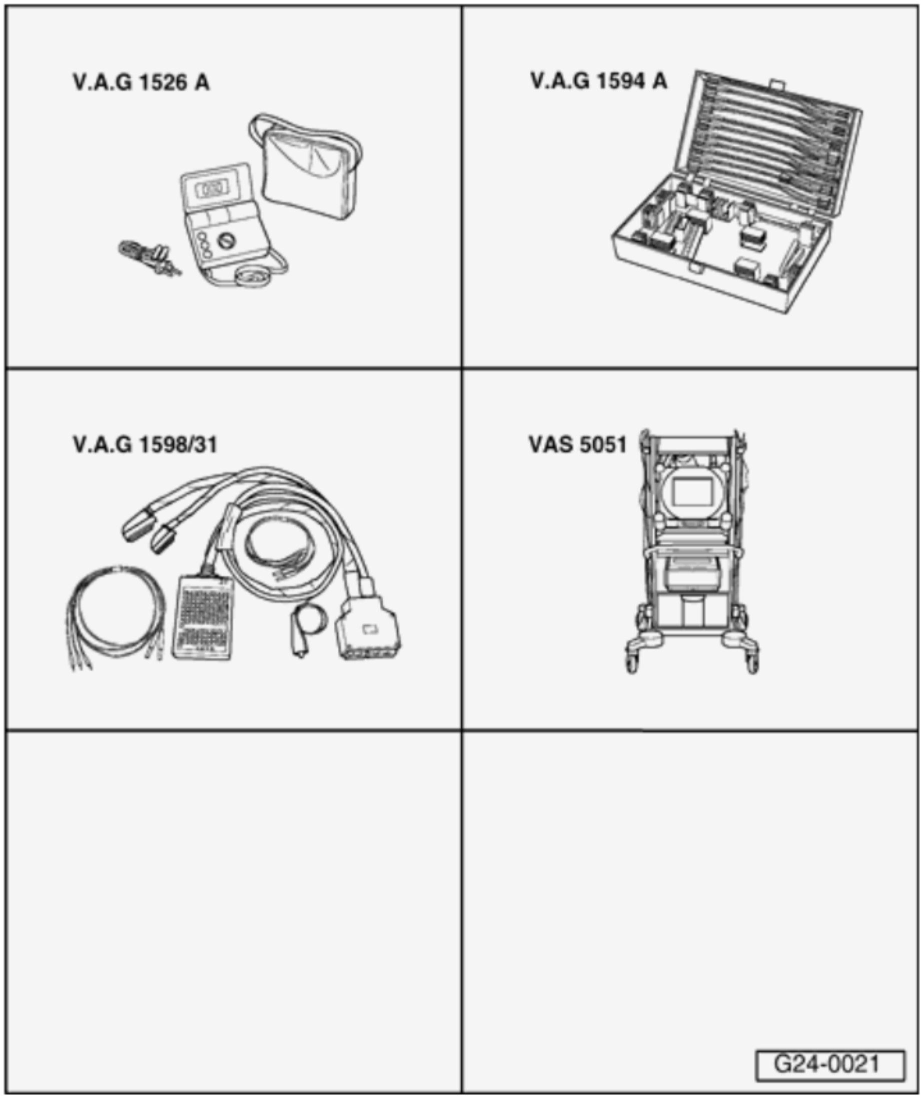

Fig. 228: Identifying Special Tools - Oxygen Sensors And Oxygen Sensor Control Behind Catalytic Converter, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

Test requirements

- No leaks in exhaust system
- Engine coolant temperature at least 80°C. Refer to display group 004, display zone 3.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Engine must be running at idling speed.

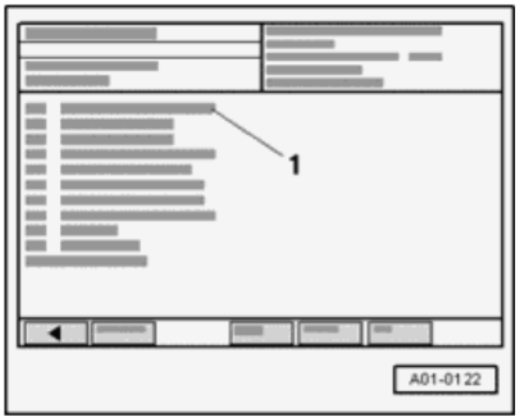

Fig. 229: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

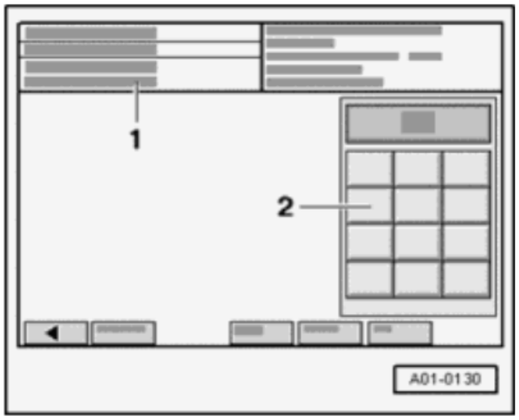

Fig. 230: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "030" for "display group number 030" in zone -2- and confirm entry by pressing -Q- button.

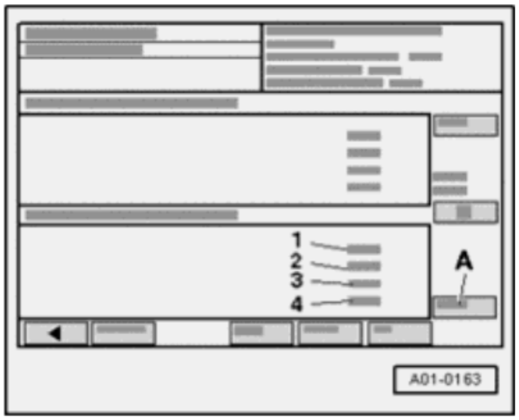

Fig. 231: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check specifications in display zones -2- and -4-.

NOTE:

- **By increasing the engine speed the specified values are achieved more quickly.**
- **The "oxygen sensor status" indicates the condition of the oxygen sensor control and the oxygen sensor.**

	Display zones			
	1	2	3	4
Display group 030: Oxygen sensor status				
Display	X X X	**X X X**	X X X	**X X X**
Display	Oxygen sensor status, Bank 1, sensor 1	**Oxygen sensor status Bank 1, sensor 2**	Oxygen sensor status, Bank 2, sensor 1	**Oxygen sensor status Bank 2, sensor 2**
Range	0 = off 1 = on	**0 = off 1 = on**	0 = off 1 = on	**0 = off 1 = on**
Specif. value	1 1 1	**1 1 0**	1 1 1	**1 1 0**
Note:	If the specification is not obtained. Refer to **Oxygen sensors behind catalytic converter, checking heating**			

Significance of 3-digit readout of display group 030			
X	X	X	**Display zones 1...4**
X			Condition of oxygen sensor heating: 0 = not active; 1 = active
	X		Oxygen sensor condition:

			0 = not active; 1 = active
		X	Oxygen sensor control 0 = not active; 1 = active

NOTE:

- **The first digit of the 3-digit display (heating) fluctuates between 0 and 1.**
- **The oxygen sensor control for oxygen sensor behind catalytic converter (bank 1, sensor 2 and bank 2, sensor 2) is not active without engine load, i.e. the last digit of the 3-digit display is 0.**

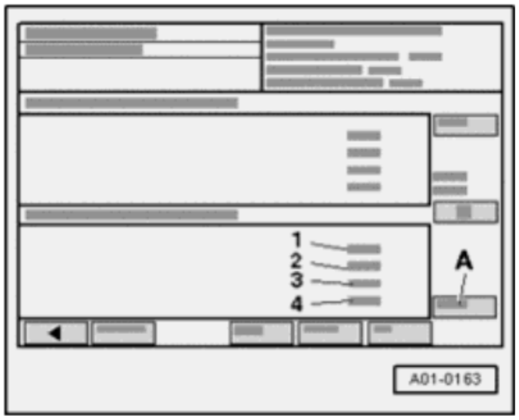

Fig. 232: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Continue with test if displays have reached "110" in display zones -2- and -4- at least once.
- Press <-- button.

Checking oxygen sensor control behind catalytic converter

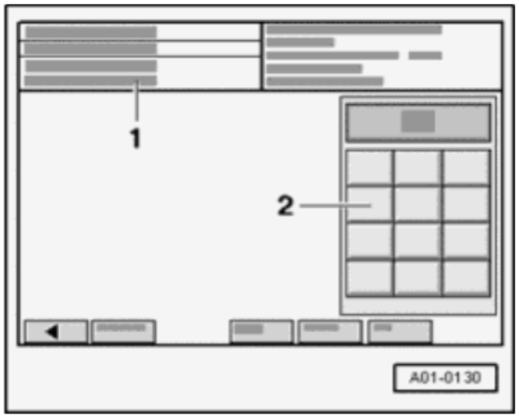

Fig. 233: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group max. input value = 255

- Enter "037" for "display group number 037" in zone -2- and confirm entry by pressing -Q- button.

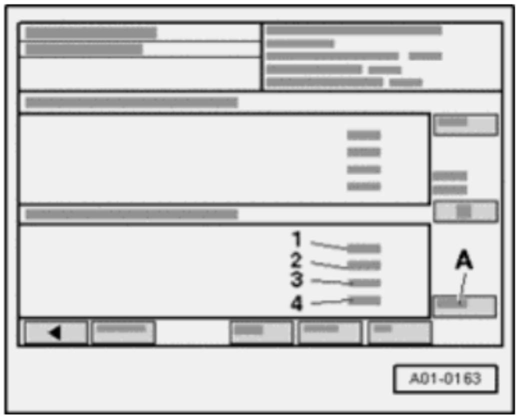

Fig. 234: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check oxygen sensor voltage in display zone -2-.
- Check oxygen sensor correction value in display zone-3- and diagnosis result in display zone -4-.

	Display zones			
	1	2	3	4
Display group 037: Diagnosis, Oxygen sensor control system (Bank 1, sensor 2)				
Display	xxx%	**x.xxx V**	**x.xx**	**---**
Display	Engine load	**Oxygen sensor Voltage Bank 1, sensor 2**	**Oxygen sensor correction value Between Bank 1, sensor 1 and Bank 1, sensor 2**	**Diagnosis status**
Range				**Test OFF Test ON Syst. OK Syst. NOK**
Specif. value	12 to 26%	**0.100 to 0.950 V**	**-0.05 to 0.05**	**Syst. OK**
Note:		If specified value is not obtained: Evaluation. Refer to **Evaluation of**		If the display shows "Syst. NOK", Cont. Refer to **Oxygen sensors and oxygen**

		display groups 037 and 038		**sensor control behind catalytic converter, checking**

Note on display zone 2:

The oxygen sensor voltage Bank 1, sensor 2 should be kept as constant as possible. Strong voltage fluctuations indicate a damaged catalytic converter.

- Press <-- button.

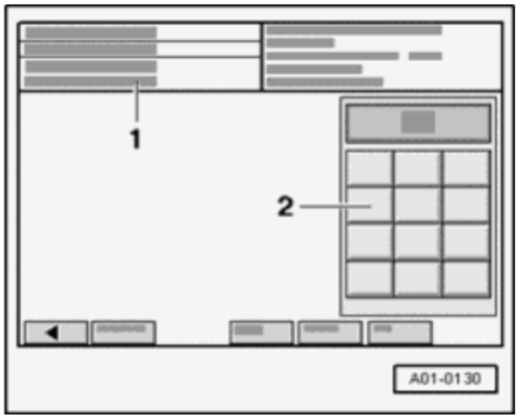

Fig. 235: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "038" for "display group number 038" in zone -2- and confirm entry by pressing -Q- button.

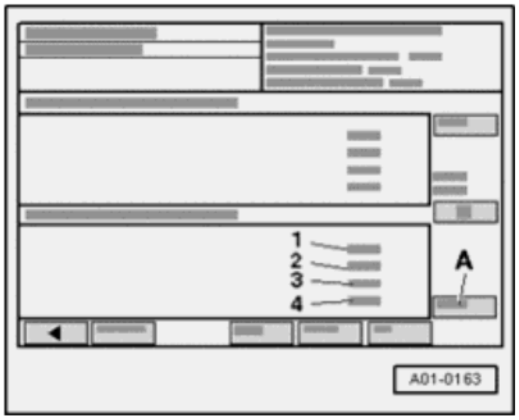

Fig. 236: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check oxygen sensor voltage in display zone -2-.
- Check oxygen sensor correction value in display zone -3- and diagnosis result in display zone -4-.

	Display zones			
	1	2	3	4
Display group 038: Diagnosis, Oxygen sensor control system (Bank 2, sensor 2)				
Display	xxx %	**x.xxx V**	**x.xx**	**---**
Display	Engine load	**Oxygen sensor Voltage Bank 2, sensor 2**	**Oxygen sensor correction value between Bank 2, sensor 1 and Bank 2, sensor 2**	**Diagnosis status**
Range				**Test OFF Test ON Syst. OK Syst. NOK**
Specif. value	12 to 26 %	**0.100 to 0.950 V**	**-0.05 to 0.05**	**Syst. OK**
Note:		If specified value is not obtained: Evaluation. Refer to **Evaluation of display groups 037 and 038**		If the display shows "Syst. NOK", Cont. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking**

Note on display zone 2:

The oxygen sensor voltage Bank 2, sensor 2 should be kept as constant as possible. Strong voltage fluctuations indicate a damaged catalytic converter.

- Exit function "04 - Basic setting" by pressing <-- button.

Evaluation of display groups 037 and 038

Display zone: 2	Possible causes of malfunction	Corrective action
Constant approx. 0.450 V	- Open circuit in line 4 between oxygen sensor and control module	- Check basic voltage. Refer to **Checking basic voltage**
	- Open circuit in line 3 between oxygen sensor and	

	control module	
Greater than 0.950 V	- Short to positive in line 4 between oxygen sensor and control module	○ Check wiring for oxygen sensor behind catalytic converter. Refer to **Oxygen sensors and oxygen sensor control behind catalytic converter, checking** .
Less than 0.100 V	- Short to ground in line 4 between oxygen sensor and control module	

Cont.

If specification in display zone 3 or 4 is not obtained:

- Perform test drive to free oxygen sensors from any possible residues and repeat test.

If specified value in display zone 3 or 4 is not obtained, even after a test drive has been performed:

- Replace relevant oxygen sensor before catalytic converter.

NOTE: If the oxygen sensor voltage is OK and after a road test the oxygen sensor correction value is still outside the specification, this indicates aging of the oxygen sensor before catalytic converter.

Checking basic voltage

- Disconnect 4-pin connector of relevant oxygen sensor behind catalytic converter: See **Fig. 101** or **Fig. 102**.

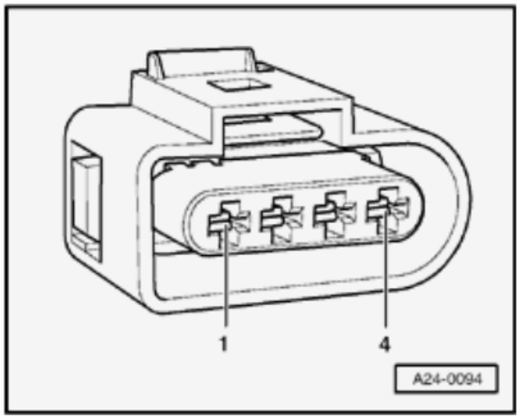

Fig. 237: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 3 and 4 to measure voltage.

- Switch ignition on.
- Specified value: 0.400 to 0.500 V
- Switch ignition off.

If specified value is not obtained:

- Check oxygen sensor wiring Bank 1. Refer to **Checking oxygen sensor wiring, Bank 1 Oxygen Sensor (O2S) Behind Three Way Catalytic converter (TWC) -G130-** or Bank 2 **Checking oxygen sensor wiring, Bank 2 Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131-**

If specified value is obtained:

- Replace relevant oxygen sensor behind catalytic converter.

Checking oxygen sensor wiring, Bank 1 Oxygen Sensor (O2S) Behind Three Way Catalytic converter (TWC) -G130-

- Disconnect 4-pin connector, bank 1, Oxygen Sensor (O2S) behind three way catalytic converter (TWC) -G130-. See **Fig. 101**.
- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

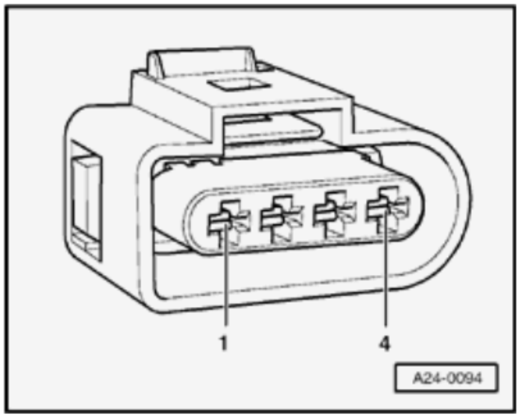

Fig. 238: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit in following wiring connections.

Connector Terminal	Test box VAG1598/31 Socket
3	68
4	69

- Repair open circuit, if necessary.

- Check for shorts between two wires.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Checking oxygen sensor wiring, Bank 2 Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131-

- Disconnect 4-pin connector, bank 2, oxygen sensor (O2S) 2 behind three way catalytic converter (TWC) -G131-. See **Fig. 102**.
- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

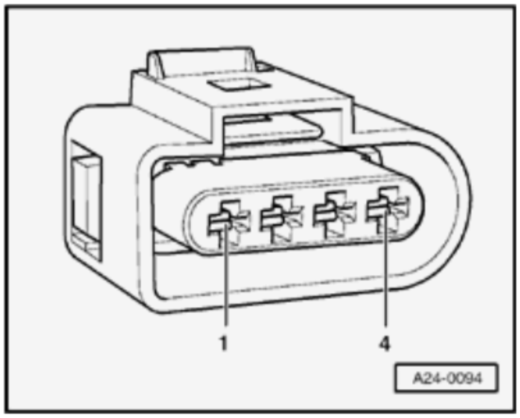

Fig. 239: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for open circuit in following wiring connections.

Connector Terminal	Test box VAG1598/31 Socket
3	10
4	11

- Repair open circuit, if necessary.
- Check for shorts between two wires.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Oxygen sensors behind catalytic converter, checking aging

Special tools and equipment

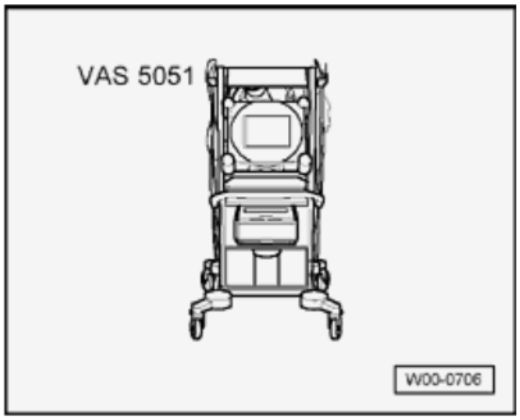

Fig. 240: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Test requirements

- Engine coolant temperature at least 80°C. Refer to display group 004, display zone 3.

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Engine must be running at idling speed.

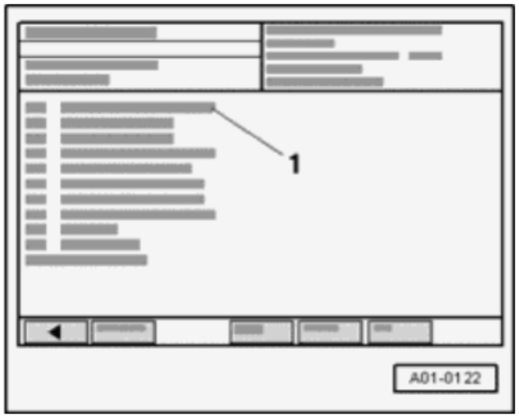

Fig. 241: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

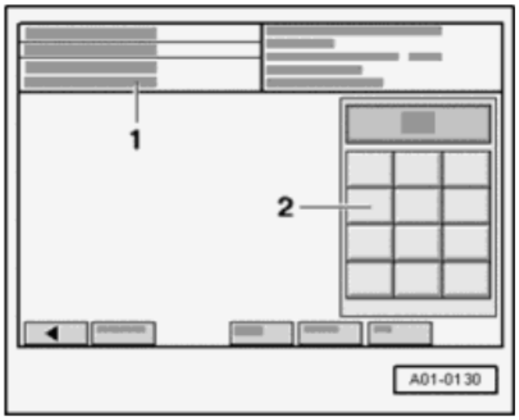

Fig. 242: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "194" for "display group number 194" in zone -2- and confirm entry by pressing -Q- button.

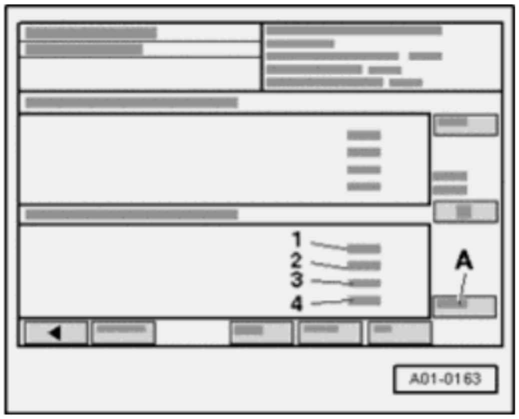

Fig. 243: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Press accelerator and brake pedal simultaneously, engine speed increases to approx. 2200 RPM.

Test conditions

- Accelerator and brake pedal pressed simultaneously, engine runs at approx. 2200 RPM.

- Check specification in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 194: Diagnosis of oxygen sensor aging (Bank 1, sensor 2 - Bank 2, sensor 2)				
Display	xxxx RPM	xxx °C	---	---
Display	Engine speed	Exhaust gas temperature	**Diagnosis status**	**Diagnosis status**
Range			**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 NOK**	**Test OFF** **Test ON** **B2-S2 OK** **B2-S2 NOK**
Specif. value	approx.2200 RPM	Above 350°C	**B1-S2 OK**	**B2-S2 OK**
Note:			If "B1-S2 NOK" or "B2-S2 NOK" is displayed, continuation. Refer to **Oxygen sensors behind catalytic converter, checking aging**	

- Press <-- button.

(Cont.)

If specification in display zones -3- and -4- is not obtained:

- Perform test drive to free oxygen sensors from any possible residues and repeat test.

If specification in display zones -3- and -4- is not obtained even after a test drive has been performed:

- Replace relevant oxygen sensor behind catalytic converter.

Oxygen sensors behind catalytic converter, checking heating

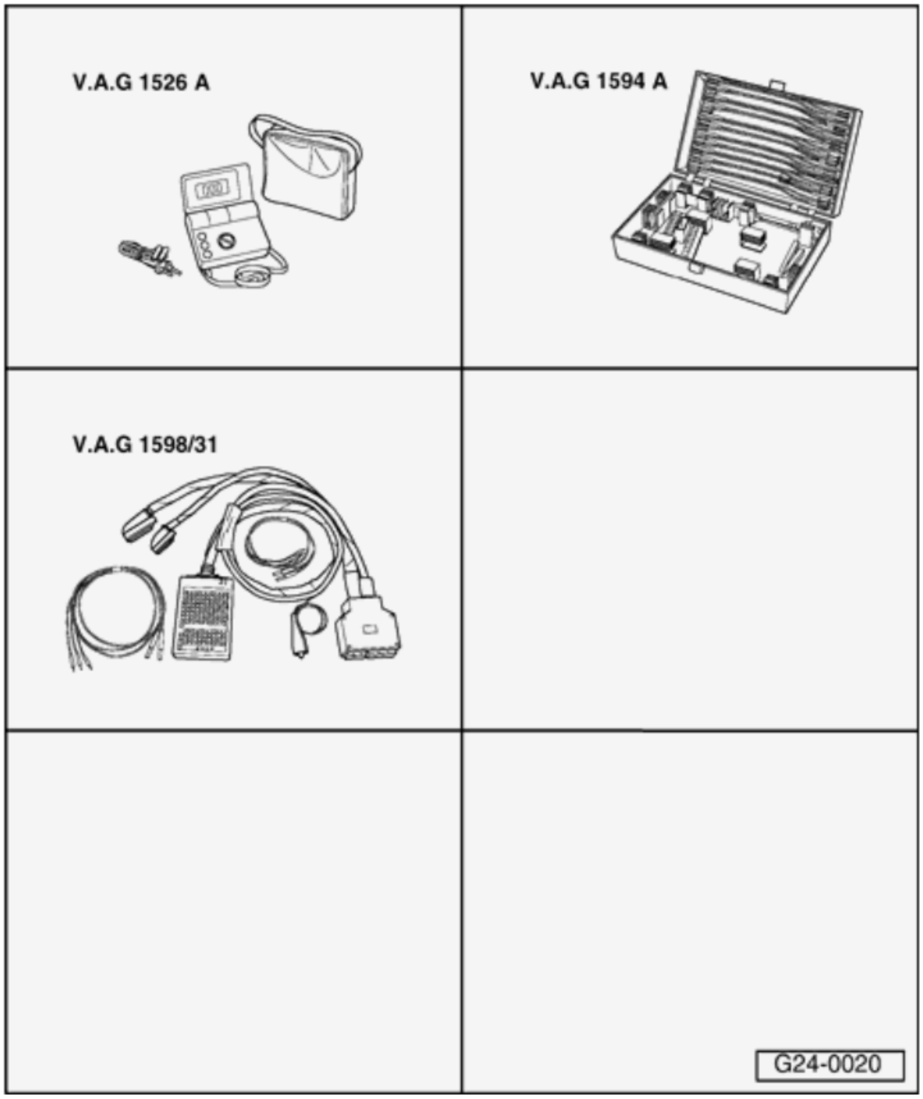

Fig. 244: Identifying Special Tools - Oxygen Sensors Behind Catalytic Converter, Checking Heating
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31

Test requirements

- Fuse for oxygen sensor heating OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Test sequence

- Disconnect 4-pin connector of relevant oxygen sensor behind catalytic converter. See **Fig. 101** or **Fig. 102**.

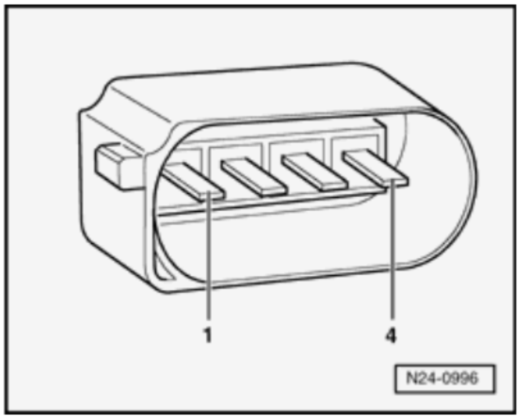

Fig. 245: Identifying 4-Pin Harness Connector Terminals 1 & 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 and 2 to measure resistance.

- Specified value at room temperature 6.4 to 47.5 ohms

If specified value is not obtained:

- Replace relevant oxygen sensor behind catalytic converter.

If specified value is obtained:

Check voltage supply for oxygen sensor heating

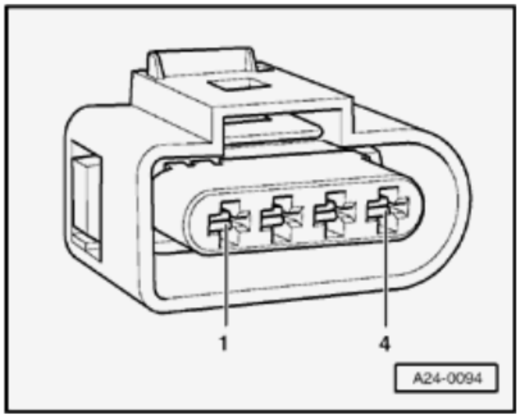

Fig. 246: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 (positive) and 2 (Ground) to measure voltage.
- Start engine.

- Specified value: approx. battery voltage

NOTE: Points at which oxygen sensor heating is switched on and off by engine control module can be observed in "Reading measured value block" function, display group number 041 and display zone 4.

If no voltage is present:

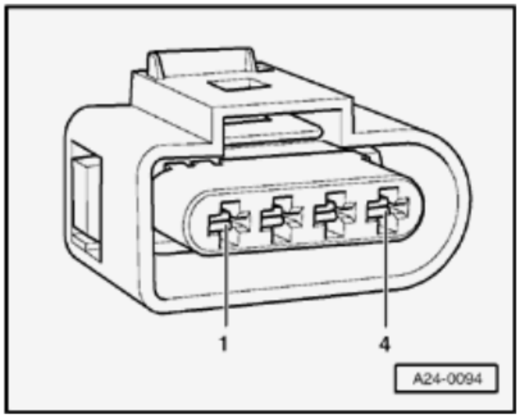

Fig. 247: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Measure to
1	Engine ground

- Operate starter briefly.

- Specified value: approx. battery voltage

If no voltage is present:

- Check wiring from terminal 1 on connector via fuse to fuel pump relay for an open circuit:

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If voltage supply is OK:

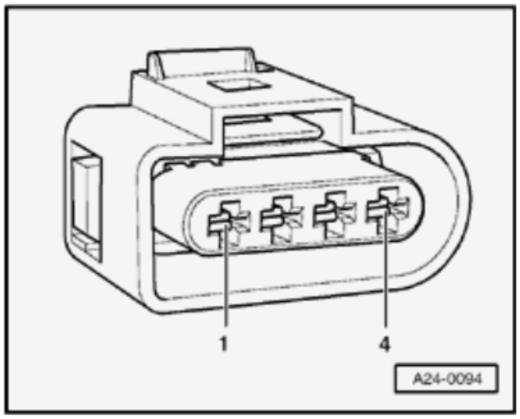

Fig. 248: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Measure to
2 (ground activation by engine control module)	Battery positive

- Start engine.
- Specified value: approx. battery voltage, may fluctuate
- Switch ignition off.

If no voltage is present:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

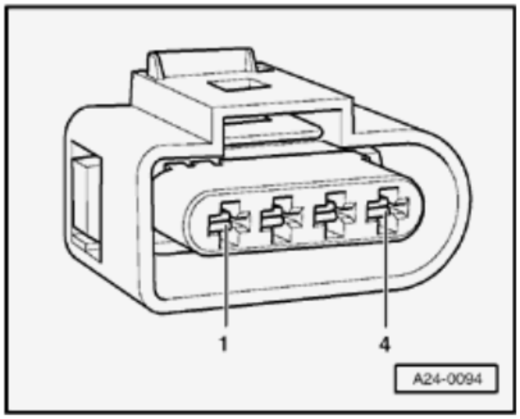

Fig. 249: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit in following wiring connections:

- Oxygen sensor (O2S) heater 1 -Z29- Bank 1 behind Cat:

Connector Terminal	Test box VAG1598/31 Socket
2	63

- Oxygen Sensor (O2S) heater 2 -Z30- Bank 2 behind Cat:

Connector Terminal	Test box VAG1598/31 Socket
2	6

- Repair open circuit, if necessary.

If wiring is OK but there is no Ground (GND) supply for oxygen sensor heater:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Oxygen sensors behind catalytic converter, recognizing interchanges

Special tools and equipment

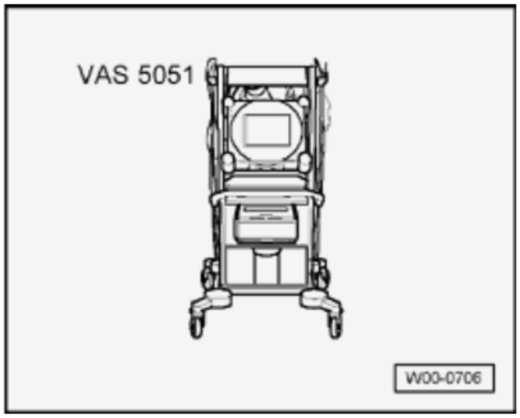

Fig. 250: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Test requirements

- Engine coolant temperature at least 80°C. Refer to display group 004, display zone 3.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

Test conditions

- Engine running at idling speed

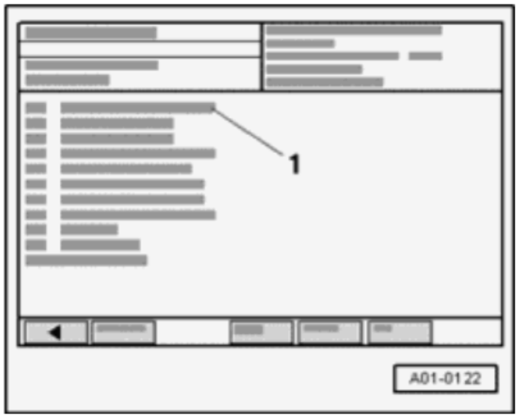

Fig. 251: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

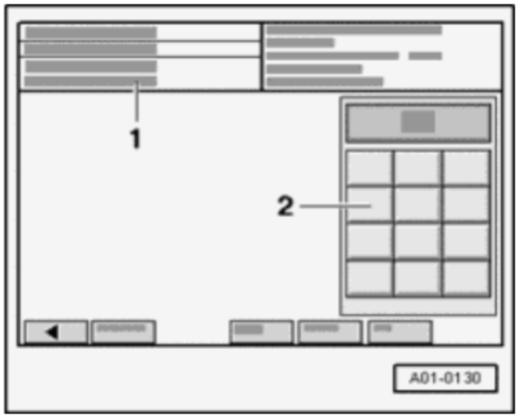

Fig. 252: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "196" for "display group number 196" in zone -2- and confirm entry by pressing -Q- button.

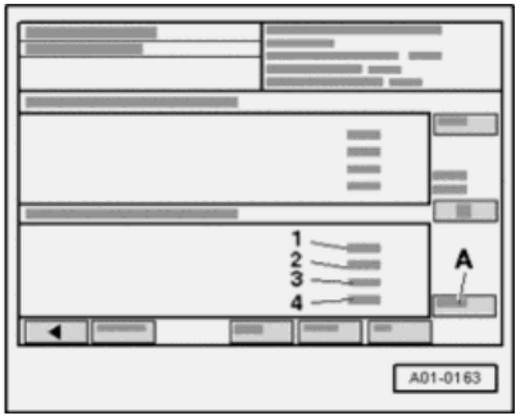

Fig. 253: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check specification in display zone -4-.

All models

	Display zones			
	1	2	3	4
Display group 196: Diagnosis of oxygen sensor interchange recognition (Bank 1, sensor 2 - Bank 2, sensor 2)				
Display	---	xxx °C	x.xxx V	**---**
Display	Diagnosis status	Oxygen sensor voltage bank 1, sensor 2	Oxygen sensor voltage bank 2, sensor 2	**Diagnosis status**
Range				**Test OFF Test ON Syst. OK Syst. NOK**
Specified value	Syst. OK	0.100 to 0.950 V	0.100 to 0.950 V	Syst. OK
Note:				**If "Syst. NOK" is displayed: Check routing of oxygen sensor wires**

- Exit function "04 - Basic setting" by pressing <-- button.

Oxygen sensors before catalytic converter, removing and installing

Special tools and equipment

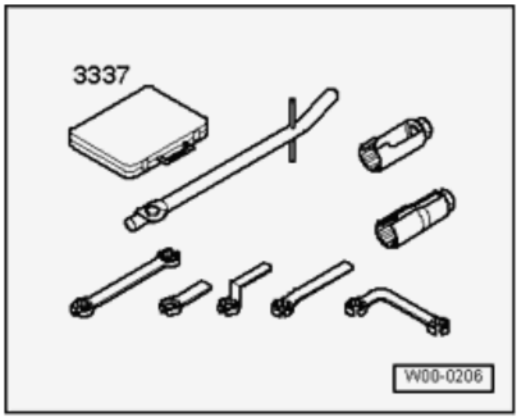

Fig. 254: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Box wrench set 3337
- High-temperature paste G 052 112 A3

Removing

- Disconnect connector of relevant oxygen sensor. See **Fig. 101** or **Fig. 102**.
- Undo cable ties.
- Remove oxygen sensor using special tool 3337.

Installing

When installing, note the following points:

NOTE:

- **The screw thread on the oxygen sensor is coated with assembly paste. This paste must not be allowed to penetrate the openings on the sensor.**
- **When installing, the cable ties must be re-installed at exactly the same points in order to prevent contact between the oxygen sensor wire and the exhaust pipe.**
- **Tightening torque 55 Nm.**

Oxygen sensors behind catalytic converter, removing and installing

Special tools and equipment

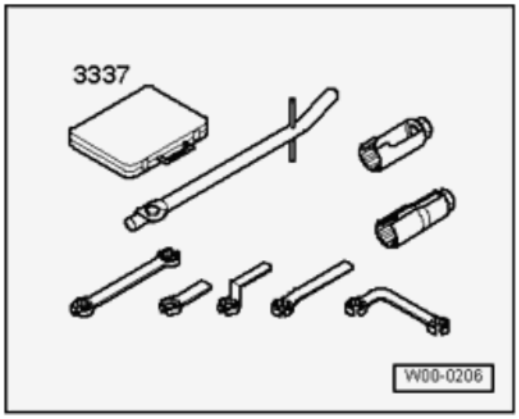

Fig. 255: Identifying Ring Spanner 7-Piece Set 3337
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 3337 wrench, 7-piece set
- High temperature paste G 052 112 A3

Removing left oxygen sensor behind catalytic converter

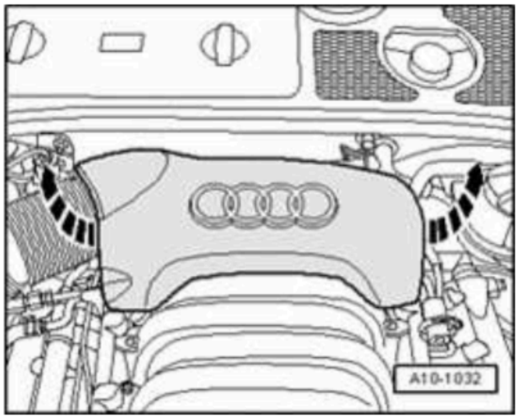

Fig. 256: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

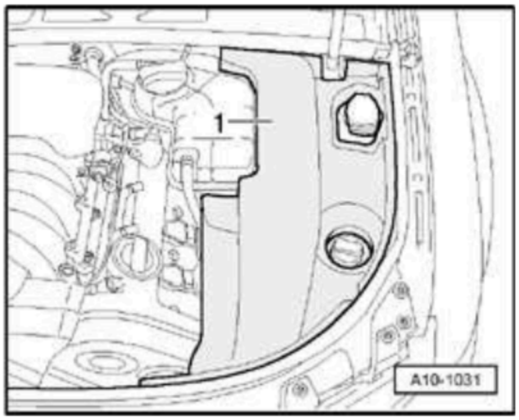

Fig. 257: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (left side).

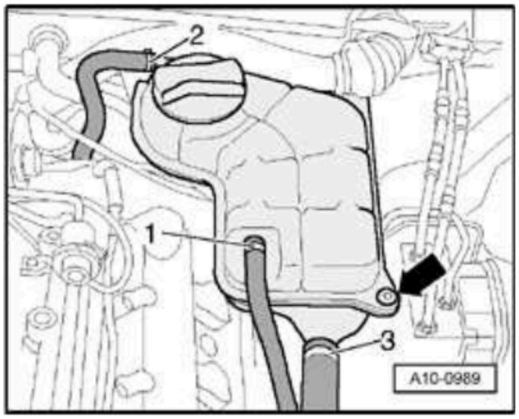

Fig. 258: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove coolant reservoir (arrow)
- Disconnect electrical wiring to Engine Coolant Level (ECL) Warning Switch -F66- at bottom of expansion tank.
- Tie coolant expansion tank with connected coolant hoses -1 to 3- to side.

Vehicles with automatic transmission

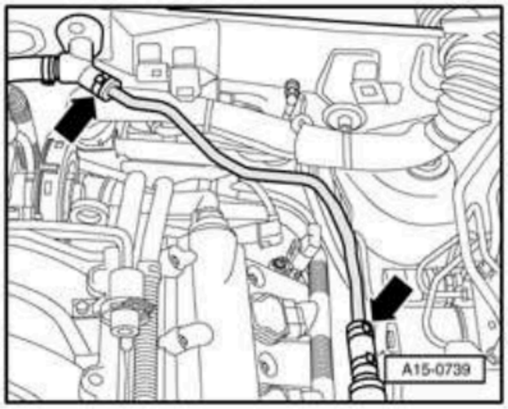

Fig. 259: Disconnecting Vacuum Hose To Brake Booster
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect vacuum hose to brake booster (arrows).

All

- Remove heat shield for harness connectors at left of bulkhead, if installed.

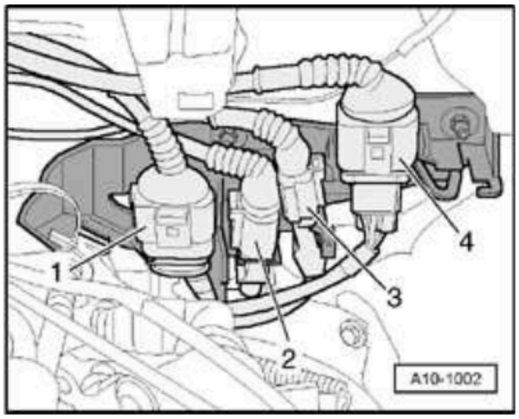

Fig. 260: Removing Harness Connectors From Bracket At Left Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1- to -4- from bracket at left of bulkhead.
- Disconnect electrical harness connector -1-.
- Move wire to oxygen sensor clear.

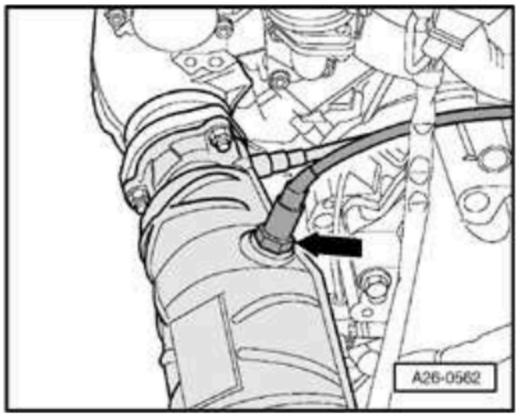

Fig. 261: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: Illustration is shown with engine removed.

Removing right oxygen sensor behind catalytic converter

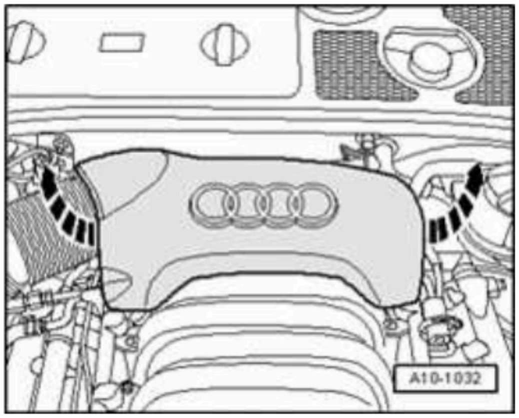

Fig. 262: Removing Rear Engine Cover
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rear engine cover (arrows).

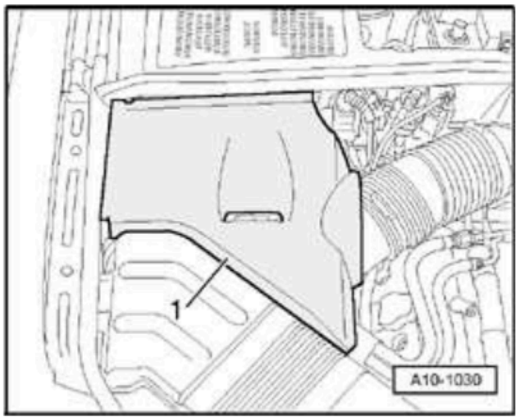

Fig. 263: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover -1- in engine compartment (right side).

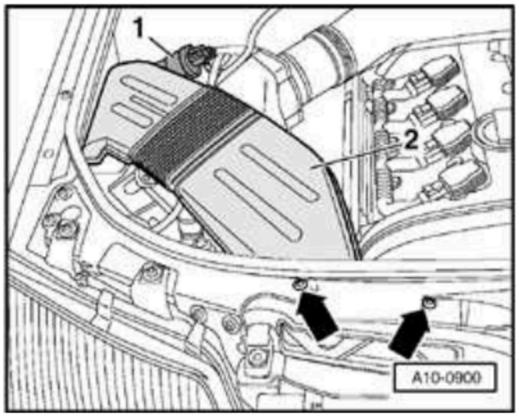

Fig. 264: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Disconnect Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- -1- at air guide.
- Remove air guide -2-.

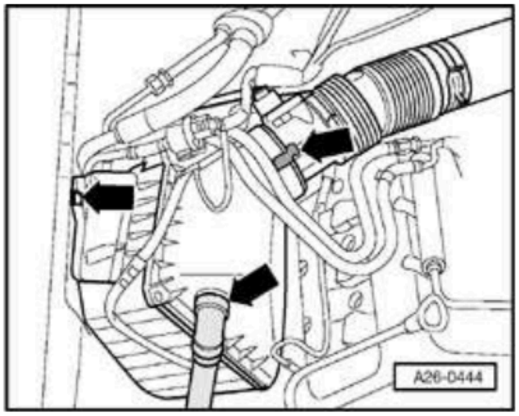

Fig. 265: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).

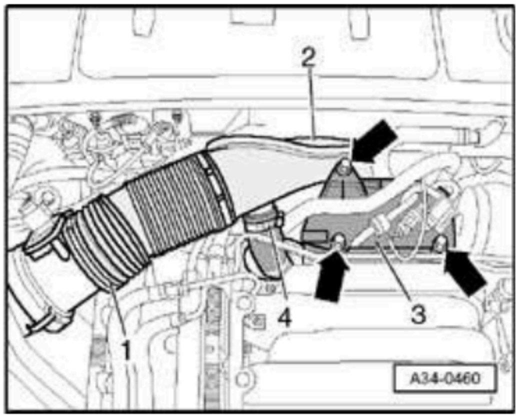

Fig. 266: Identifying Holding Plate, Intake Air Hose, Hose & Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts for holding plate -3- for solenoid valves (arrows).
- Disconnect electrical harness connector at Mass Air Flow (MAF) sensor.
- Remove hose -4- of crankshaft housing ventilation from air guide -2-.

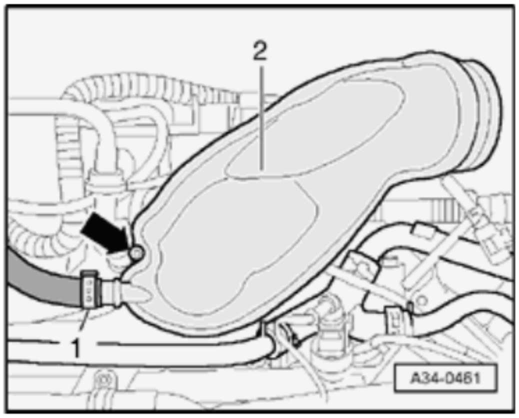

Fig. 267: Removing Bolt And Disconnect Air Duct At Throttle Valve Control Module
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolt (arrow) and disconnect air guide -2- at throttle valve control module.
- Disconnect hose -1- from air guide.

NOTE: Illustration depicts air guide with the removed engine from rear.

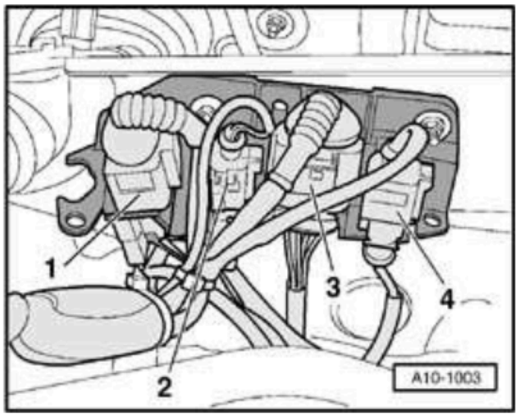

Fig. 268: Removing Harness Connectors From Bracket At Right Of Bulkhead
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove harness connectors -1- to -4- from bracket at right of bulkhead.
- Disconnect electrical harness connector -3-.
- Move wire to oxygen sensor clear.

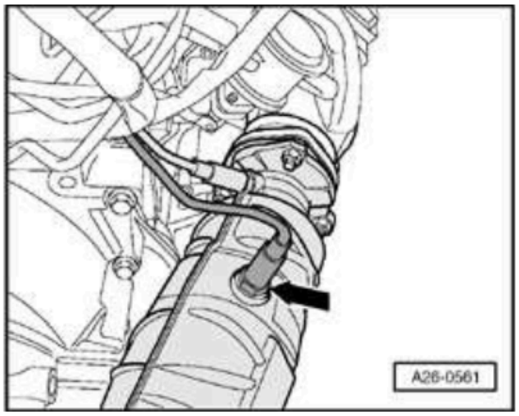

Fig. 269: Unscrewing Oxygen Sensor Behind Catalytic Converter Using Special Tool 3337/7
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove oxygen sensor behind catalytic converter (arrow) using special tool 3337/7.

NOTE: **Illustration is shown with engine removed.**

Installing

Installation is reverse of removal, noting the following:

NOTE:

- **Oxygen sensor threads are coated with an assembly paste. This paste must not be allowed to enter the sensor openings.**
- **Cable ties must always be installed again in exactly the same place to prevent the sensor wire from contacting the exhaust pipe.**

- **Tightening torque: 55 Nm**

FUEL TANK BREATHER, CHECKING

Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking

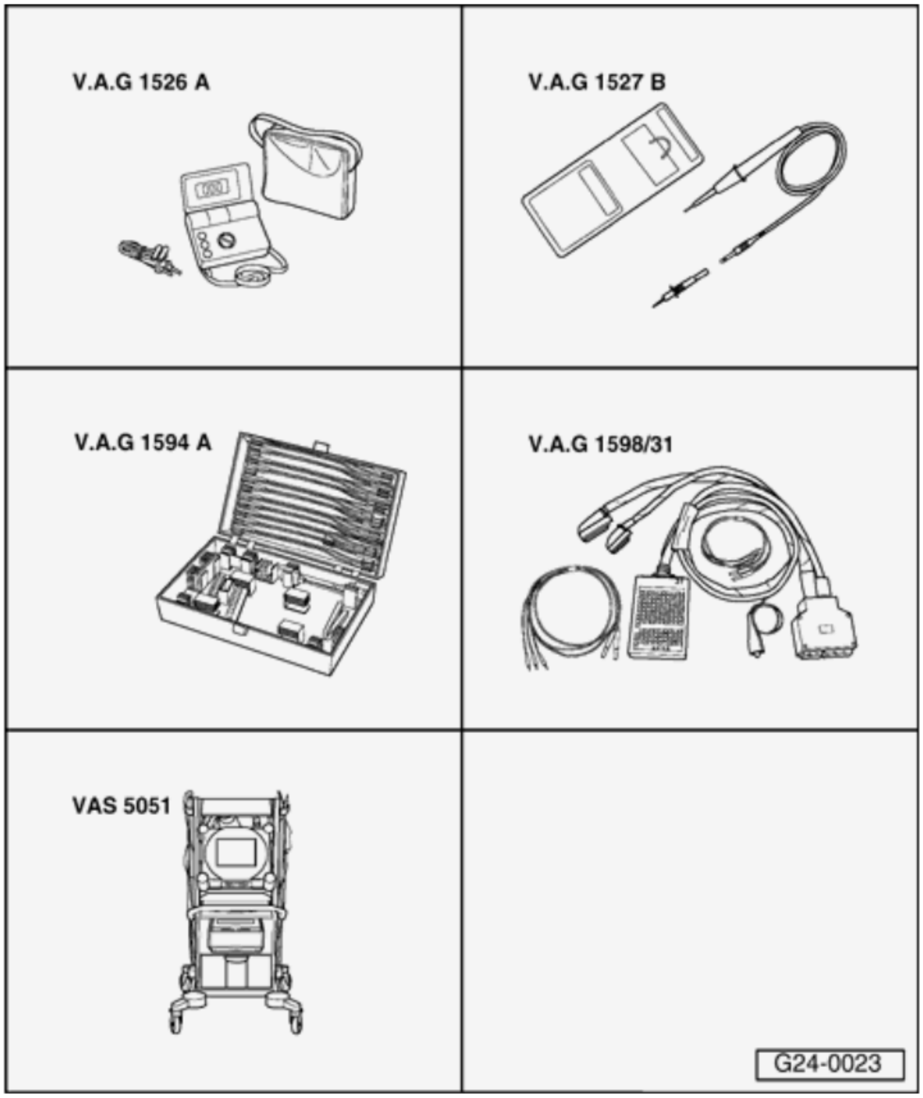

Fig. 270: Identifying Special Tools - Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A

- VAG1598/31
- VAS5051 with VAS5051/1

Testing for leaks

When there is no electrical supply, solenoid valve remains closed.

- Disconnect hoses from EVAP canister purge regulator valve but leave electrical connector plugged in.
- Connect auxiliary hose to one connection of EVAP canister purge regulator valve.
- Connect testing and information system VAS5051 and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.
- Initiate final control diagnosis and activate EVAP canister purge regulator valve -N80-. Refer to **Output Diagnostic Test Mode (DTM)**.

- The valve should click..
- .. and should open and close (check by blowing into the auxiliary hose).

- Press <-- -button to end function "03 - Final Control Diagnosis" [also known as Output Diagnosis Test Mode (DTM)].

If valve does not open and close properly:

- Replace EVAP canister purge regulator valve -N80-.

If the injector does not click:

Checking internal resistance

- Disconnect connector on EVAP canister purge regulator valve.

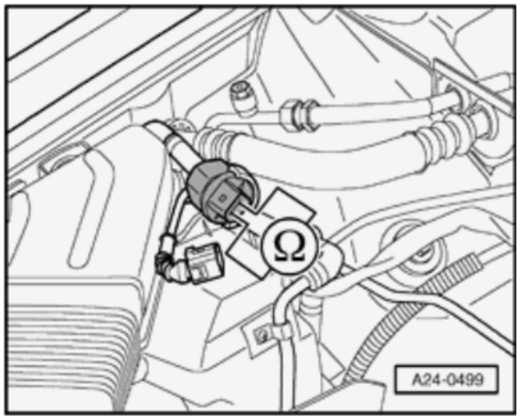

Fig. 271: Measuring Fuel Injector Resistance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter to injector to measure resistance.

- Specified value: 22 to 30 ohms

If specification is not obtained:

- Replace Evaporative Emission (EVAP) canister purge regulator valve -N80-.

If specified value is obtained:

Checking power supply

Test requirements

- Fuse for EVAP canister purge regulator valve OK.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Fuel pump relay OK; checking. Refer to **Fuel Pump (FP) relay -J17- and activation, checking**.

NOTE: The EVAP canister purge regulator valve receives its power supply via the fuel pump relay.

- Disconnect connector on EVAP canister purge regulator valve.

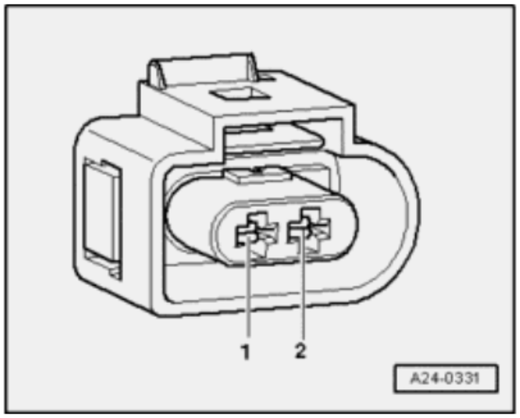

Fig. 272: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B as follows:

Connector Terminal	Measure to
1	Engine ground

- Operate starter briefly (engine may start).

- LED should illuminate.

If the LED does not illuminate:

- Check wiring from terminal 1 on connector via fuse to fuel pump relay for an open circuit.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair open circuit, if necessary.

If the LED illuminates:

Checking actuation

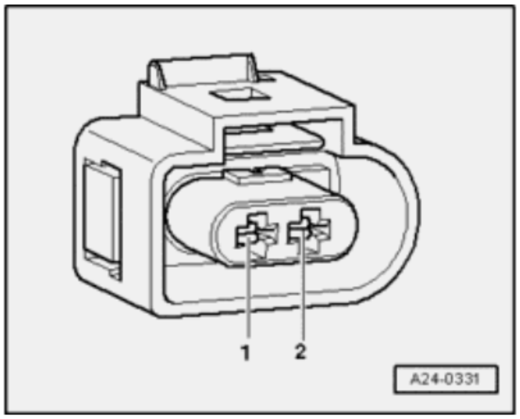

Fig. 273: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B to terminals 1 (positive) and 2 of connector.
- Initiate final control diagnosis and activate Evaporative Emission (EVAP) canister purge regulator valve -N80-. Refer to **Output Diagnostic Test Mode (DTM)**.

- LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

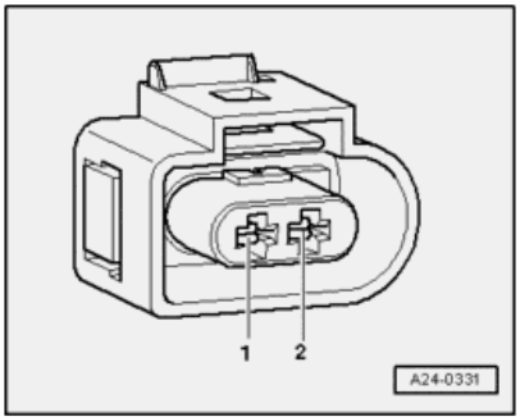

Fig. 274: Identifying 2-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connection:

Connector Terminal	Test box VAG1598/31 Socket
2	64

- Repair any open/short circuit as necessary.

If the wiring is OK:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

ELECTRONIC ENGINE POWER CONTROL (EPC) (ELECTRONIC THROTTLE), CHECKING

Function of the electronic throttle system

In the electronic throttle system, the throttle valve is not operated by a cable connected to the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to the engine control module by two accelerator position sensors (variable resistances located in a single housing) connected to the accelerator pedal.

The position of the accelerator pedal (decided by the driver) is one of the main input parameters to the engine control module.

The throttle valve is activated, over the full range of engine speed and power, by an electric motor (throttle valve actuator) in the throttle valve control module.

The throttle valve actuator moves the throttle valve as instructed by the engine control module.

With the ignition switched on and the engine not running, the engine control module controls the throttle valve precisely in accordance with the signals from the accelerator position sensors. This means that when the accelerator is pressed half way down, the throttle valve actuator opens the throttle valve to an equivalent extent; the throttle valve is then about half open.

When the engine is running (and under load), the engine control module can open and close the throttle valve independently of the accelerator position sensors.

As an example, the throttle valve can be fully open even though the accelerator pedal is only pressed half way down. This has the advantage of preventing throttle losses at the throttle valve.

Under certain engine load conditions, markedly improved emission and consumption figures are also obtained.

The engine torque necessary can be provided by the engine control module by an optimum combination of throttle opening and boost pressure.

The electronic throttle system does not simply consist of one or two components, rather a system which includes all the components which contribute to determining the position of the throttle valve and to controlling and monitoring this position. These components include, for example, the throttle valve control module, the EPC warning lamp, the engine control module.

Malfunction lamp for electronic throttle in instrument cluster

NOTE: The Electronic Power Control (EPC) Warning Lamp -K132- is also known as the EPC warning lamp.

"EPC" is an abbreviation for Electronic Power Control and refers to the electronic throttle control system.

When the ignition is switched on, the engine control module checks all the components of importance to the electronic throttle system.

After switching on the ignition the engine control module switches on the EPC warning lamp. The EPC warning lamp goes out shortly after starting the engine, if on the one hand, the engine control module does not detect any malfunctions in the EPC system, and, if actuation of the lamp by the engine control module is OK.

If a malfunction is detected in the electronic throttle system while the engine is running, the engine control module switches on the EPC warning lamp. (These DTCs are listed in the DTC table). At the same time, an entry is made in the engine control module Diagnostic Trouble Code (DTC) memory.

Electronic Power Control (EPC) warning lamp -K132-, checking

Functional check on EPC warning lamp

- ○ Switch ignition on.
- The engine control module switches on the EPC warning lamp.
- ○ Start engine.

- Shortly after starting the engine the EPC warning lamp goes out if no DTC in relation to the electronic throttle is stored in the DTC memory.

NOTE: **The switch-on signal for the malfunction lamp is transferred via CAN bus to the instrument cluster by the engine control module. Check the data exchange between engine control module and other CAN-control modules. Refer to Data exchange between engine control module and other CAN-control modules, checking**

Throttle valve control module -J338-, checking

The following components are located in the housing of the throttle valve control module.

- Throttle drive (power accelerator actuation) -G186- (This is an electric motor which is activated by the engine control module. This electric motor opens the throttle valve against the force of a spring).
- Angle sensor -1- for throttle drive (power accelerator actuation) -G187-
- Angle sensor -2- for throttle drive (power accelerator actuation) -G188-

NOTE:

- **Housing for throttle valve control module must not be opened.**
- **The angle sensors are in the form of potentiometers (variable resistances). They provide the position of the throttle valve to the engine control module completely independently of one another.**
- **The potentiometers cannot be adjusted mechanically. The settings are made as part of basic setting (function 04) using the vehicle diagnosis, measurement and information system VAS5051.**

Throttle valve control module -J338-, adaptation

The adaptation process enables the engine control module to learn the various positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control module. The feedback signal indicating the position of the throttle valve comes from the two throttle valve actuator angle sensors.

If the Throttle valve control module -J338- or the engine control module are removed, installed or replaced or if the voltage supply from the engine control module is interrupted, adaptation must always be performed.

The learning process (adaptation process) is performed:

- Automatically if the ignition is switched on once for at least 10 seconds without activating the starter or the accelerator pedal and the engine control module recognizes "adaptation requirement". In this case, it is not obvious whether the adaptation process was successful or not. Adaptation requirement is recognized if stored voltage values from the angle sensors do not coincide with current measured voltage values in a certain tolerance band.
- By initiating the basic setting (Function 04) of display group 060 with ignition switched on.

NOTE: Engine will not start during automatic adaptation.

Special tools and equipment

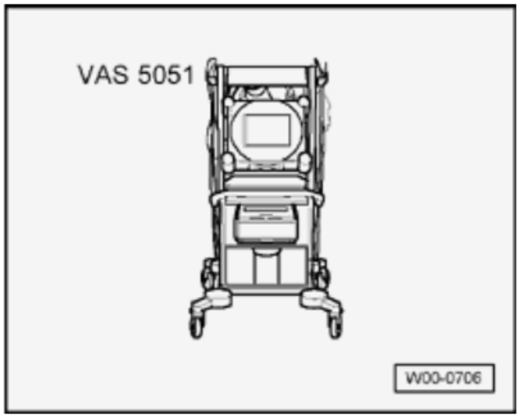

Fig. 275: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Requirements

- No DTCs recorded in DTC memory; check Diagnostic Trouble Code (DTC) memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- Engine stopped, ignition switched on
- Accelerator pedal not depressed.
- Engine coolant temperature 10 to 95°C
- Intake air temperature 10 to 90°C
- Voltage supply to engine control module greater than 12.7 V, Testing. Refer to **Engine Control Module (ECM) power supply, checking**.

Procedure

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Ignition must be switched on.

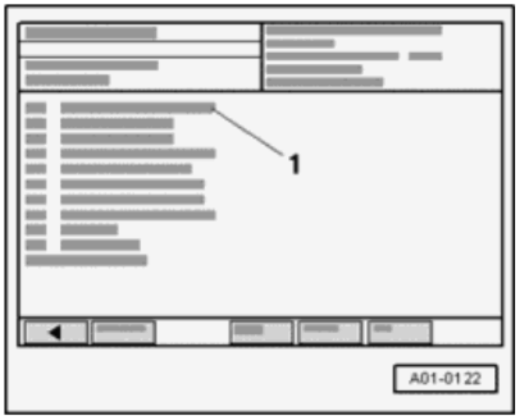

Fig. 276: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

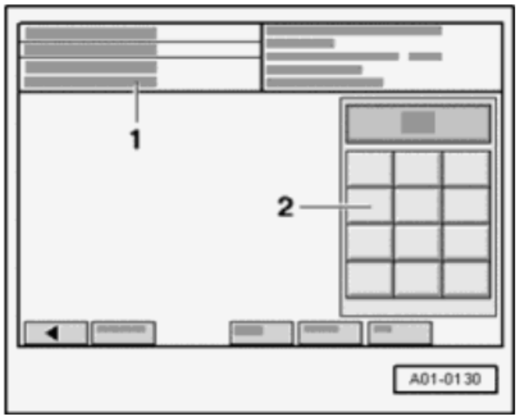

Fig. 277: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "060" for "display group number 060" in zone -2- and confirm entry by pressing -Q- button.

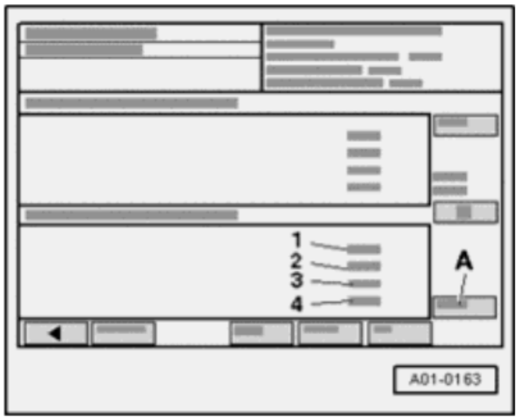

Fig. 278: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.
- Check specifications for throttle valve control module in display zones -3- and -4-.

All models

The throttle valve actuator is first connected without current.

In this condition, the throttle valve is pulled into an emergency running position by a mechanical spring which is located in the throttle valve control module. The values supplied by the two angle sensors in this emergency running position are stored in the engine control module.

The throttle valve is then opened by a predetermined amount. When this value is reached, the throttle valve actuator is again disconnected from the electricity supply. The mechanical spring should then close the throttle valve to the previously learned emergency running position within a specified period of time (spring test).

The throttle valve actuator then closes the throttle valve; the values supplied by the angle sensors in the throttle valve control module are stored in the engine control module.

If the engine control module disconnects the throttle valve actuator from the electricity supply while the vehicle is being driven, the result will be an increased and fluctuating idling speed and a very poor throttle response.

	Display zones			
	1	2	3	4
Display group 060: Adaptation of throttle valve control module				
Display	xx %	xx %	**x**	**---**
Display	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Adaptation stage counter**	**Adaptation status**
Range			**0 to 8**	**ADP process running**

				ADP OK **ERROR**
Specif. value	3 to 93%	97 to 3%	**8**	**ADP OK**
Note:			**After adaptation the adaptation stage counter reaches figure 8. (Figures may be skipped)**	If "ERROR" is displayed: Interrogate Diagnostic Trouble Code (DTC) memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** . If specified value is not obtained:**Throttle Valve Control Module -J338-, adapting**

NOTE: **"ADP" in display zone 4 stands for "Adaptation".**

NOTE: **If the adaptation is interrupted by the control module, the reason could be one of the following:**

- **The throttle valve cannot close completely (e.g. dirt).**
- **The battery voltage is too low.**
- **Throttle valve control module or wiring is faulty.**
- **Engine was started or accelerator was activated during the adaptation process.**
- **Distortion of throttle valve housing (check screw connection).**

When adaptation process is interrupted, message "Function is unknown or cannot be carried out at the moment" is displayed on tester. The next time the ignition is switched on (for several seconds), the adaptation process is automatically performed again.

- **Exit function "04 - Basic setting" by pressing <-- button.**

Angle sensor for throttle valve actuator, checking

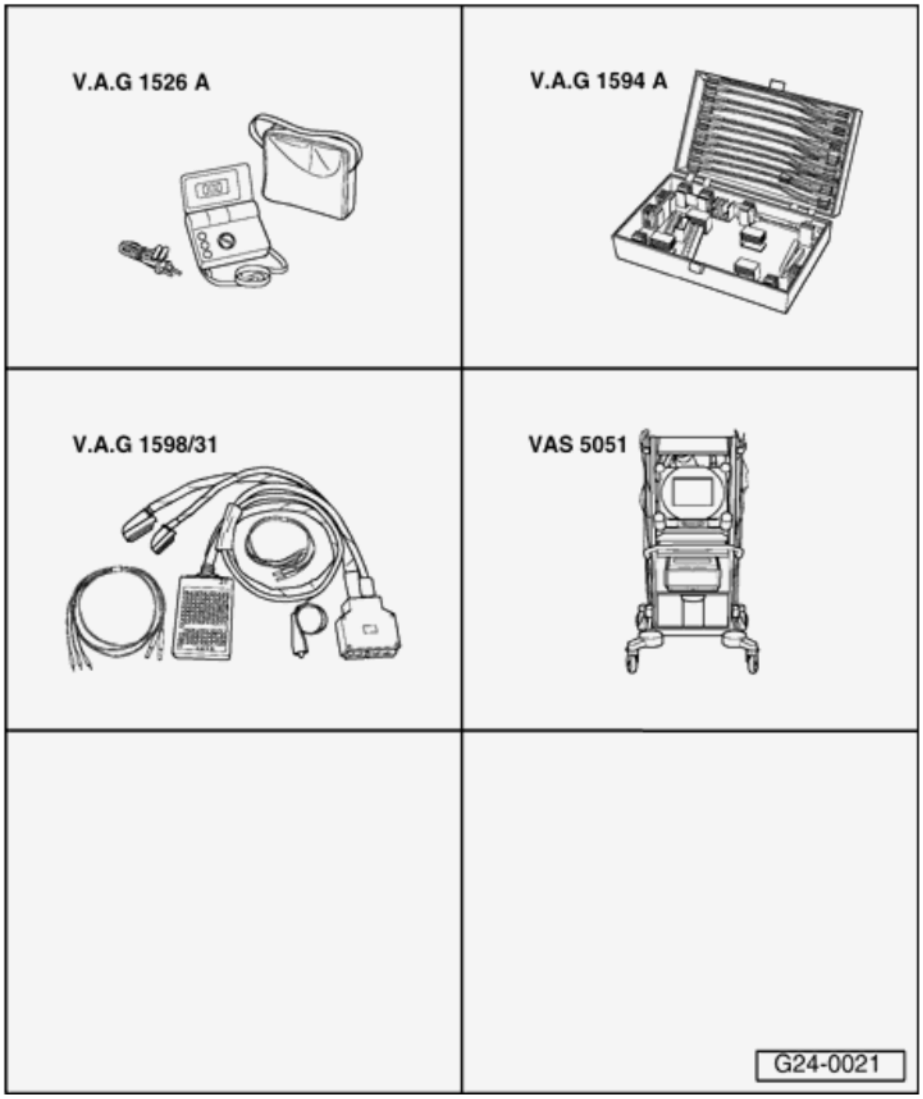

Fig. 279: Identifying Special Tools - Angle Sensor For Throttle Valve Actuator, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

The Angle sensor -1- for throttle drive (power accelerator actuation) -G187- and Angle sensor -2- for throttle drive (power accelerator actuation) -G188- signal the position of the throttle valve to the engine control module. Both angle sensors are located in the throttle valve control module.

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

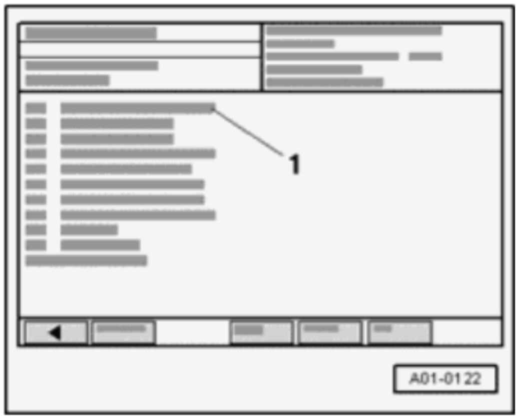

Fig. 280: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

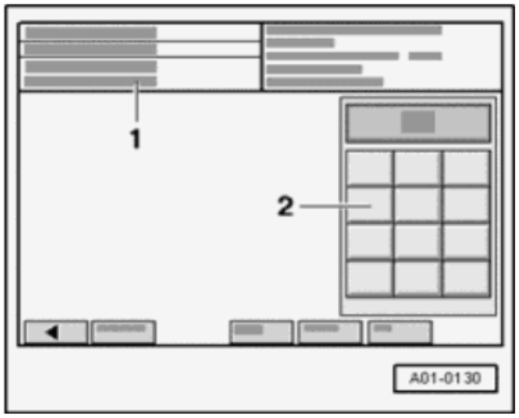

Fig. 281: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "062" for "display group number 062" in zone -2- and confirm entry by pressing -Q- button.

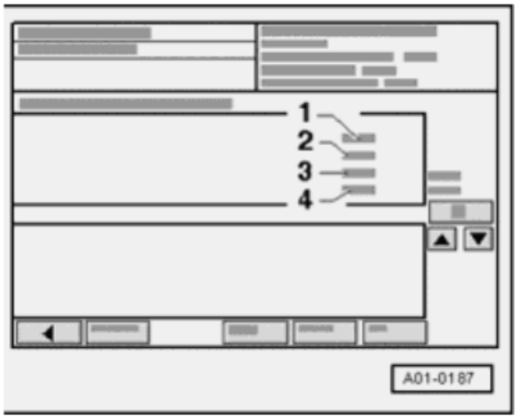

Fig. 282: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -1- and -2-.

	Display zones			
	1	2	3	4
Display group 062: Electronic throttle potentiometer voltages				
Display	**xx%**	**xx%**	xx%	xx%
Display	**Throttle valve angle (angle sensor 1)**	**Throttle valve angle (angle sensor 2)**	Sensor 1 for Accelerator pedal position	Sensor 2 for Accelerator pedal position
Specif. value	**3 to 93%**	**97 to 3%**	12 to 97%	4 to 49%

NOTE: **The engine control module converts and displays the voltage readings from the angle sensors as percentages of 5 V. (A 5 Volt supply corresponds to 100%).**

- Observe readouts in display zones 1 and 2.
- Slowly depress accelerator pedal.

Percentage displayed in zone 1 should rise evenly. Tolerance range from 3 to 93% is not fully utilized.

Percentage displayed in zone 2 should fall evenly. Tolerance range from 97 to 3% is not fully utilized.

NOTE:

- **The reason why the value in display zone 1 rises and that in zone 2 falls is that the potentiometers (angle sensors) in the throttle valve control module operate in opposite directions.**
- **This means that the voltage picked off by one of the angle sensors runs in the direction of 5 V. (As the throttle is opened, the voltage becomes greater and the percentage increases).**

- **The voltage picked off by the angle sensor 2 runs from 5 V in the direction of 0 V. (As the throttle is opened, the voltage becomes smaller and the percentage decreases).**

- Exit function "08 - Read measured value block" by pressing <-- button.

If the displays are not as described:

- Check throttle valve control module voltage supply and wiring. Refer to **Checking the voltage supply to the throttle valve control module.**. Pay particular attention to connectors, which may be disconnected or corroded.
- Check accelerator position sensor. Refer to **Accelerator position sensor, checking**.

Checking the voltage supply to the throttle valve control module.

- Disconnect connector from throttle valve control module.
- Switch ignition on.

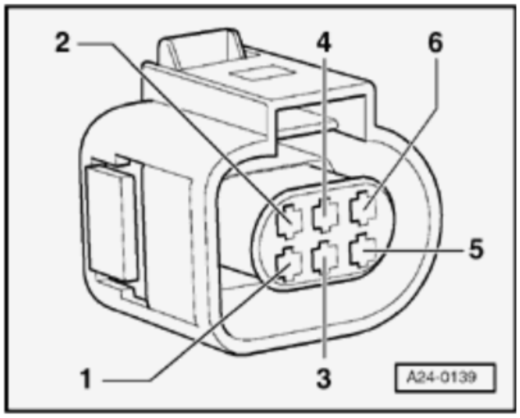

Fig. 283: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Specified value
2 + ground	approx. 5 V
2 + 6	approx. 5 V

If the specified values are not obtained:

Checking wiring

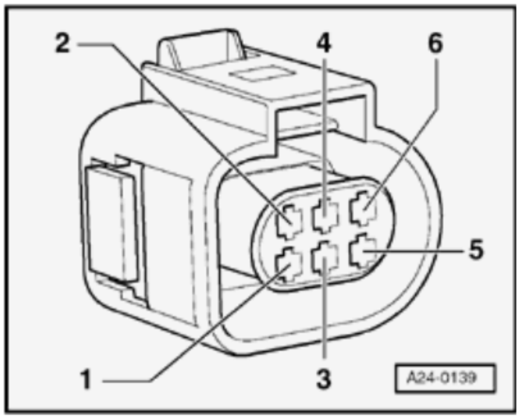

Fig. 284: Identifying 6-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from throttle valve control module.
- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Check for open circuit and short to Ground/positive or Ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
1	92
2	83
3	117
4	84
5	118
6	91

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace throttle valve control module.

Accelerator position sensor, checking

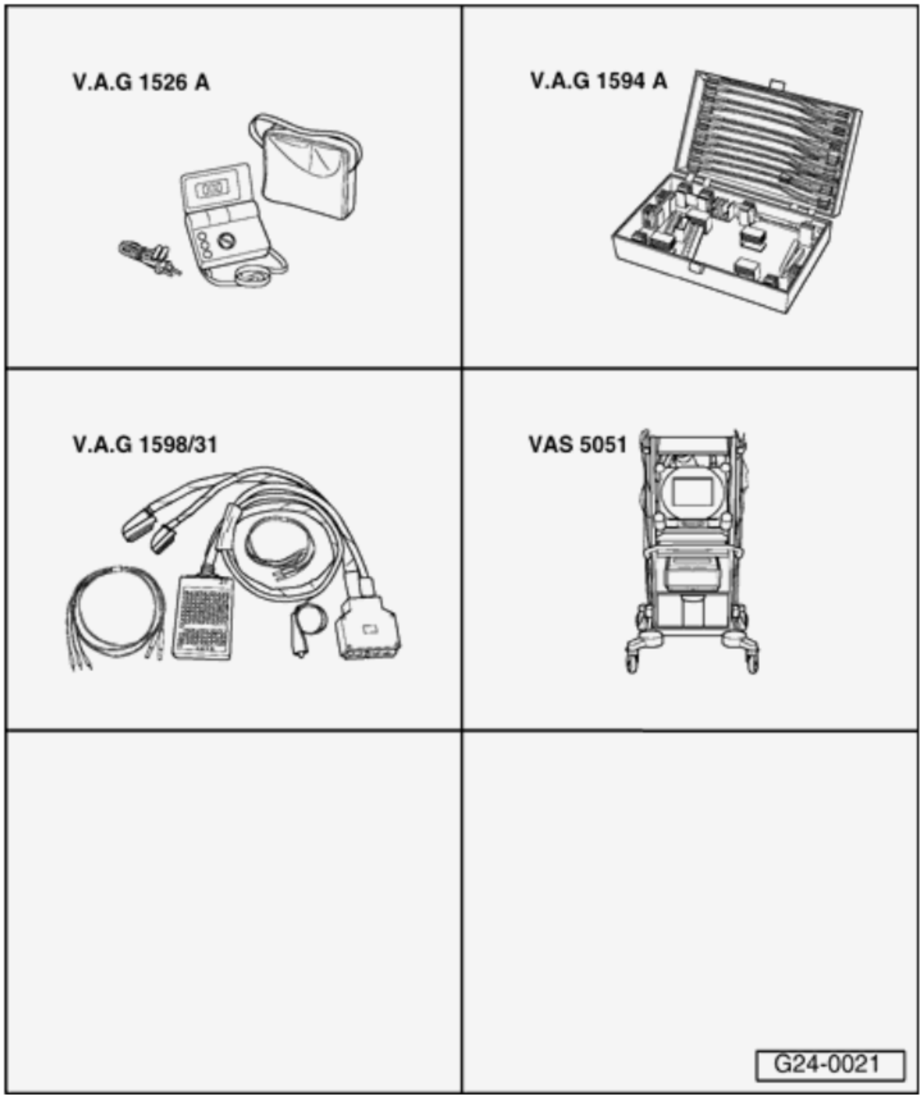

Fig. 285: Identifying Special Tools - Accelerator Position Sensor, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

Both Throttle Position (TP) sensor -G79- and Sender -2- for accelerator pedal position -G185- are located on the accelerator pedal and completely independently signal the driver's requirements to the engine control module. Both sensors are located in one housing.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

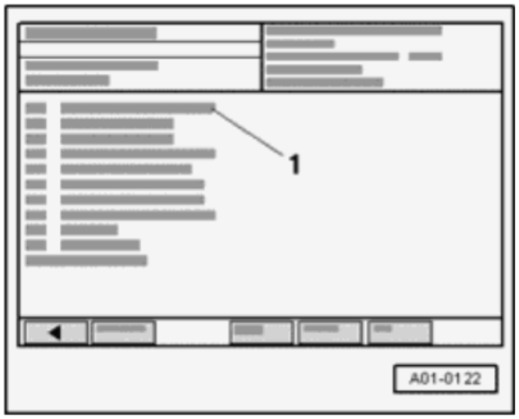

Fig. 286: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

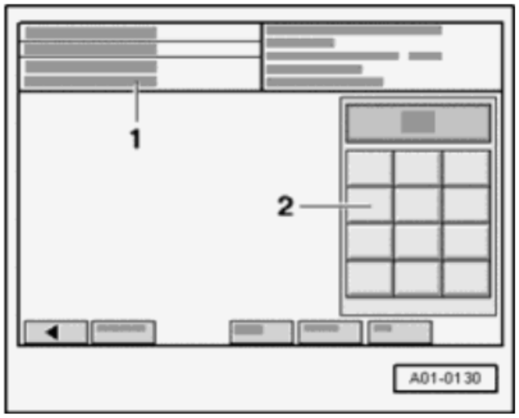

Fig. 287: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "062" for "display group number 062" in zone -2- and confirm entry by pressing -Q- button.

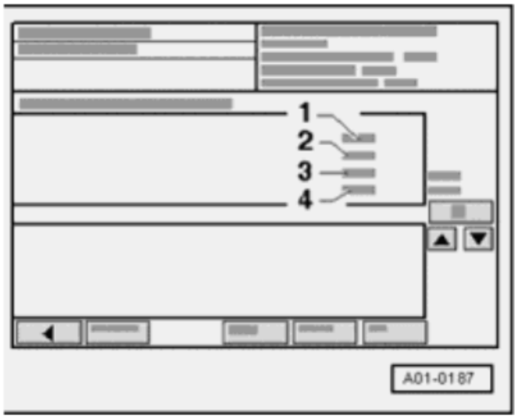

Fig. 288: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check specified values for electronic throttle potentiometer voltages in display zones -3- and -4-.

	Display zones			
	1	2	3	4
Display group 062: Electronic throttle potentiometer voltages				
Display	xx%	xx%	**xx%**	**xx%**
Display	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Sensor 1 for Accelerator pedal position**	**Sensor 2 for Accelerator pedal position**
Specif. value	3 to 93%	97 to 3%	**12 to 97%**	**4 to 49%**

NOTE: The engine control module converts and displays the voltage readings from the angle sensors as percentages of 5 V. (A 5 Volt supply corresponds to 100%).

- Observe readouts in display zones 3 and 4.
- Slowly depress accelerator pedal.

Percentage displayed in zone 3 should rise evenly. Tolerance range from 12 to 97% is not fully utilized.

Percentage displayed in zone 4 should also rise evenly. Tolerance range from 4 to 49% is not fully utilized.

NOTE: The value displayed in zone 3 must always be about twice as large as that in zone 4.

- Exit function "08 - Read measured value block" by pressing <-- button.

If the displays are not as described:

- Check voltage supply and wiring for accelerator position sensor. Refer to **Checking voltage supply for accelerator position sensors**.

If the displays are not as described:

Checking voltage supply for accelerator position sensors

- Remove driver's storage compartment:

Refer to

- **68 - INTERIOR EQUIPMENT**
- **68 - INTERIOR EQUIPMENT** for BODY INTERIOR - CABRIOLET

- Disconnect connector for accelerator position sensors.
- Switch ignition on.

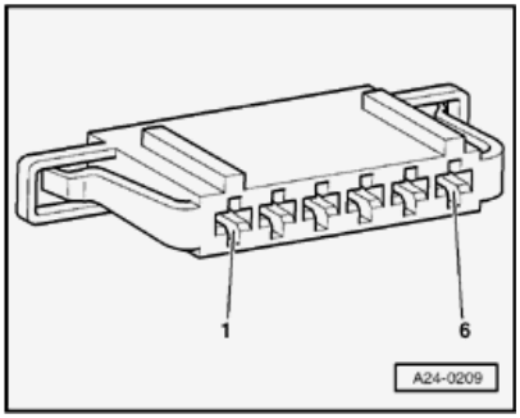

Fig. 289: Accelerator Pedal Position Sensor Harness Connector Terminals 1 And 6
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Specified value
1 + ground	approx. 5 V
1 + 5	approx. 5 V
2 + ground	approx. 5 V
2 + 3	approx. 5 V

If specifications are obtained:

- Additionally check signal wires.

If the specified values are not obtained:

Checking wiring

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

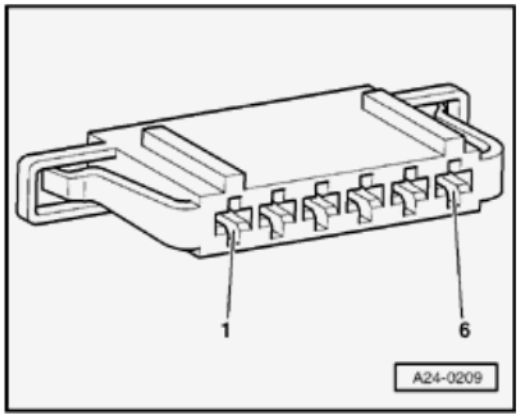

Fig. 290: Accelerator Pedal Position Sensor Harness Connector Terminals 1 And 6
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connection:

Connector Terminal	Test box VAG1598/31 Socket
1	72
2	73
3	36
4	35
5	33
6	34

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace accelerator position sensors.

Refer to **20 - FUEL SUPPLY SYSTEM**

Kickdown function, adapting

If accelerator pedal position sensors or engine control module are replaced kick down function must be adapted on vehicles with automatic transmission.

Special tools and equipment

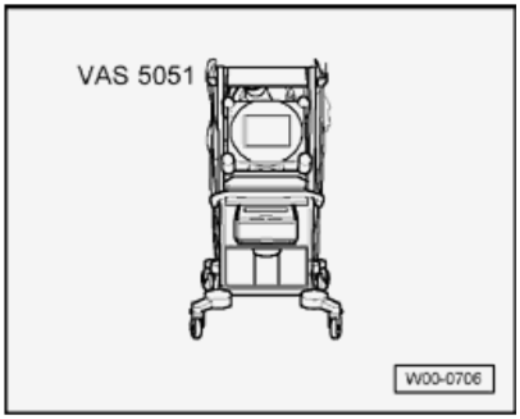

Fig. 291: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Preconditions

- No DTCs recorded in DTC memory; check Diagnostic Trouble Code (DTC) memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .
- Engine stopped, ignition switched on

Procedure

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Ignition must be switched on.

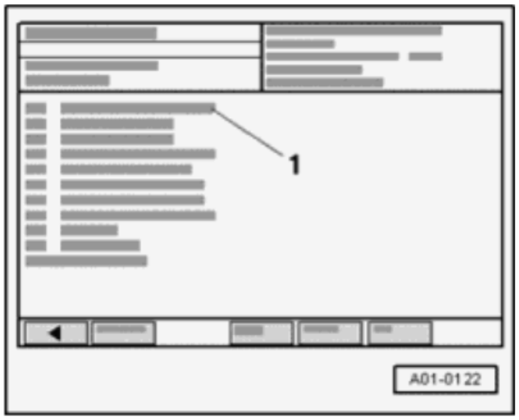

Fig. 292: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "04 - Basic setting".

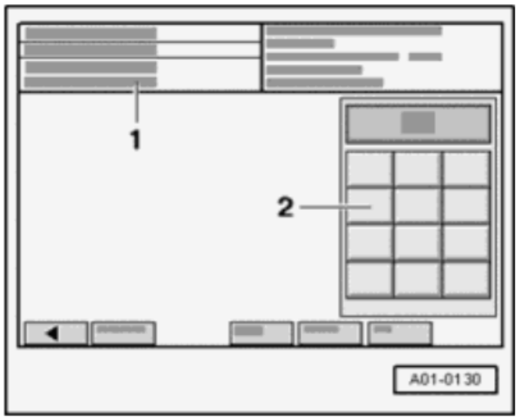

Fig. 293: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "063" for "display group number 063" in zone -2- and confirm entry by pressing -Q- button.

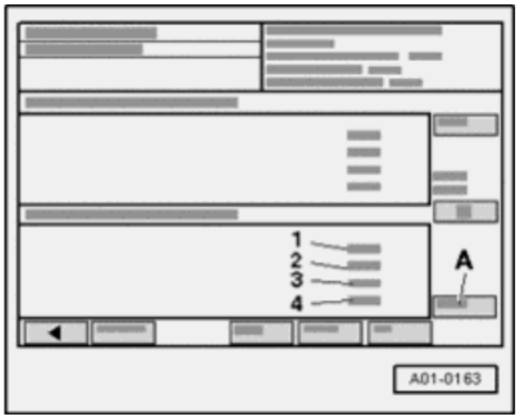

Fig. 294: Diagnostic System VAS 5051: Display - Display Fields
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Activate basic setting by pressing -A- button.

NOTE: You will now be instructed to: "Operate kick down".

- Fully depress accelerator pedal beyond kickdown point and keep it pressed.

NOTE: During the kickdown point adaptation process, "Kickdown ADP running" is shown on the display. After successful adaptation of the kickdown point "Kickdown ADP OK" appears on the display.

- Check indication in display field -4-.

All models:

	Display zones			
	1	2	3	4
Display group 063: Adapting kickdown function				
Display	xx%	xx%	**Kick down**	**---**
Display	Sensor 1 for Accelerator pedal position	Adapted kick down value sensor 1 for accelerator pedal position.	**Kick down**	**Adaptation status**
Range			**Kick down**	**Starting** **ADP process running** **ADP OK** **ERROR**
Specif. value	79 to 94%	79 to 94%	**Kick down**	**ADP OK**
Note:				If "ERROR" is displayed: Check Diagnostic Trouble Code (DTC) memory. Refer to **Diagnostic Trouble Code (DTC) memory, checking** .

NOTE:

- **"ADP" in display zone 4 stands for adaptation.**
- **If "ERROR" can be displayed, if e.g. accelerator pedal is not pressed when instructed by tester, or if accelerator pedal was released while adaptation was already running but process was not yet complete. In both cases it is necessary to exit the "Basic setting" mode and restart the adaptation process afresh. Refer to Kickdown function, adapting.**

Brake light switch and brake pedal switch, checking

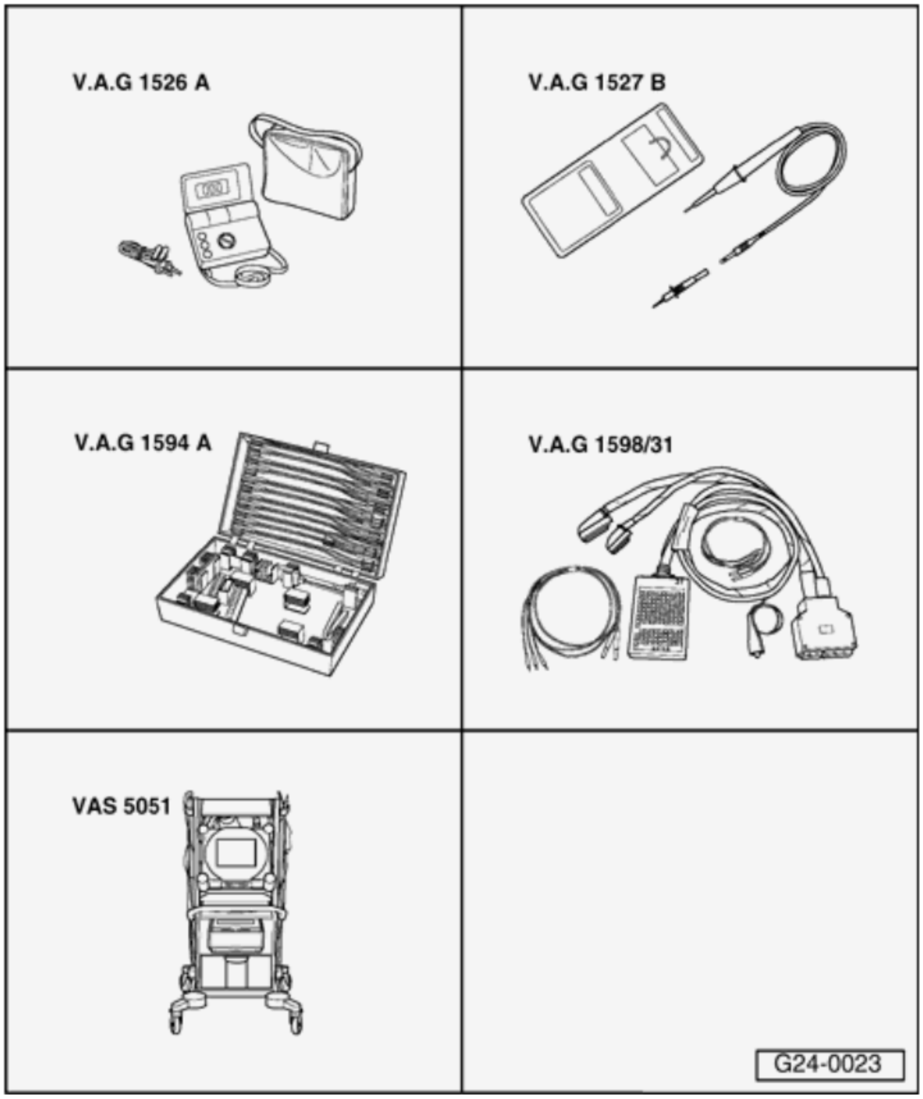

Fig. 295: Identifying Special Tools - Brake Light Switch And Brake Pedal Switch, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

- VAS5051 with VAS5051/1

NOTE: **Command from accelerator pedal sensor (potentiometer) to engine control module for opening throttle valve is suppressed for safety reasons when brake is pressed. For this purpose, the control module requires signals from both the**

brake light switch and the brake pedal switch.

If the brakes are activated when the accelerator pedal is held at a constant position, the engine speed is immediately reduced to idling speed. Incorrectly adjusted switches may lead to unwanted regulating actions

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Ignition must be switched on.

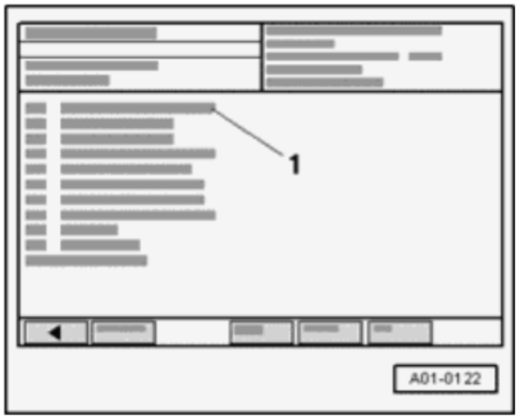

Fig. 296: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

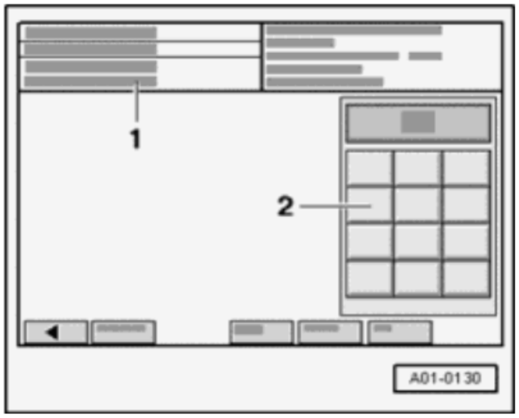

Fig. 297: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "066" for "display group number 066" in zone -2- and confirm entry by pressing -Q- button.

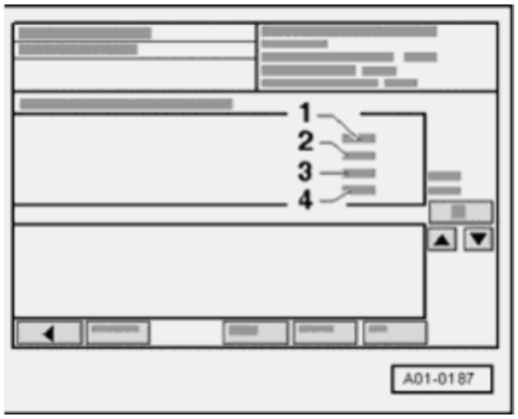

Fig. 298: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -2-.

	Display zones			
	1	2	3	4
Display group 066: Signals to engine control module				
Display	xxx km/h	**XXXXXXXX**	xxx km/h	XXXXXXXX
Display	ACTUAL speed	**Switch settings**	SPECIFIED speed	Switch settings
Range		**0 = off 1 = on**		
Specif. value		**XXXXXX00 (with brake pedal (not pressed)**		
		XXXXXX11 (with brake pedal (pressed)		
Note:		**Value: X = no meaning. Switching points are slightly offset**		

- Exit function "08 - Read measured value block" by pressing <-- button.

If the display is not as described:

Check switch

- Remove driver's storage compartment:

Refer to

- **68 - INTERIOR EQUIPMENT**
- **68 - INTERIOR EQUIPMENT** for BODY INTERIOR - CABRIOLET

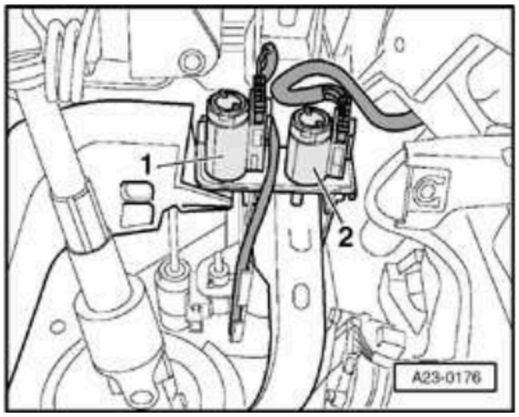

Fig. 299: Disconnecting Connector From Brake Light/Brake Pedal Switch -2-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from brake light/brake pedal switch -2-.

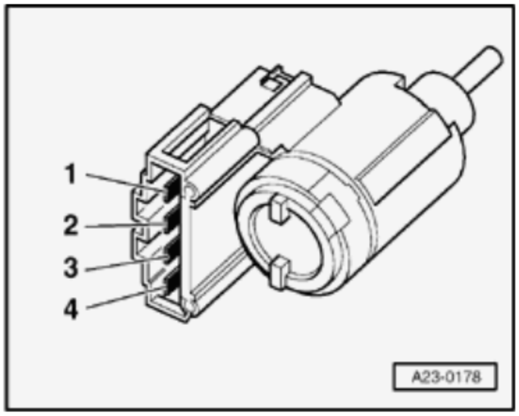

Fig. 300: Identifying Brake Light Switch & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 1 and 4 to measure resistance.

- Specified value: infinity ohms (no continuity)

- Press brake pedal.

- Specified value: approx. 0 ohms

- Connect multimeter between terminals 2 and 3 to measure resistance.
- Specified value: approx. 0 ohms
- Press brake pedal.
- Specified value: infinity ohms (no continuity)

If the specified values are not obtained:

- Replace brake light/brake pedal switch.

Refer to **46 - BRAKES - MECHANICAL COMPONENTS**

If specifications are obtained:

Checking power supply

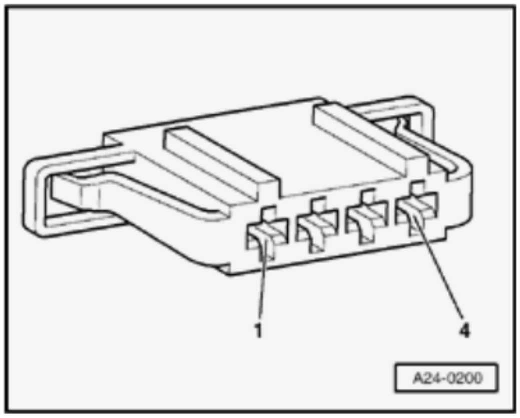

Fig. 301: Identifying 4-Pin Clutch Pedal Switch Terminals 1 & 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B as follows:

Connector Terminal	Measure to
1	Car body Ground point

- The LED should illuminate.

Connector Terminal	Measure to
3	Car body Ground point

- Switch ignition on.

- LED should illuminate.

If the LED does not illuminate:

- Check wiring for open circuit and service if necessary.

If the LED illuminates:

Checking actuation

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

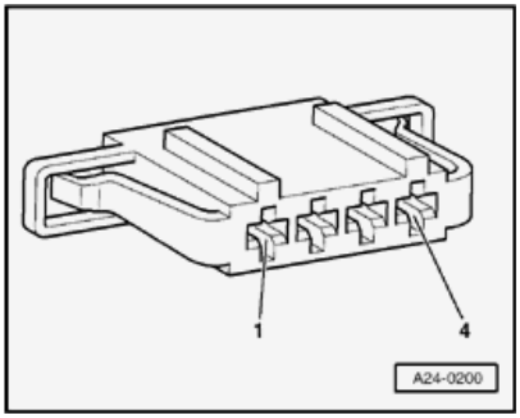

Fig. 302: Identifying 4-Pin Clutch Pedal Switch Terminals 1 & 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
2	55
4	56

- Repair any open/short circuit as necessary.

Clutch pedal switch check -F36-, checking

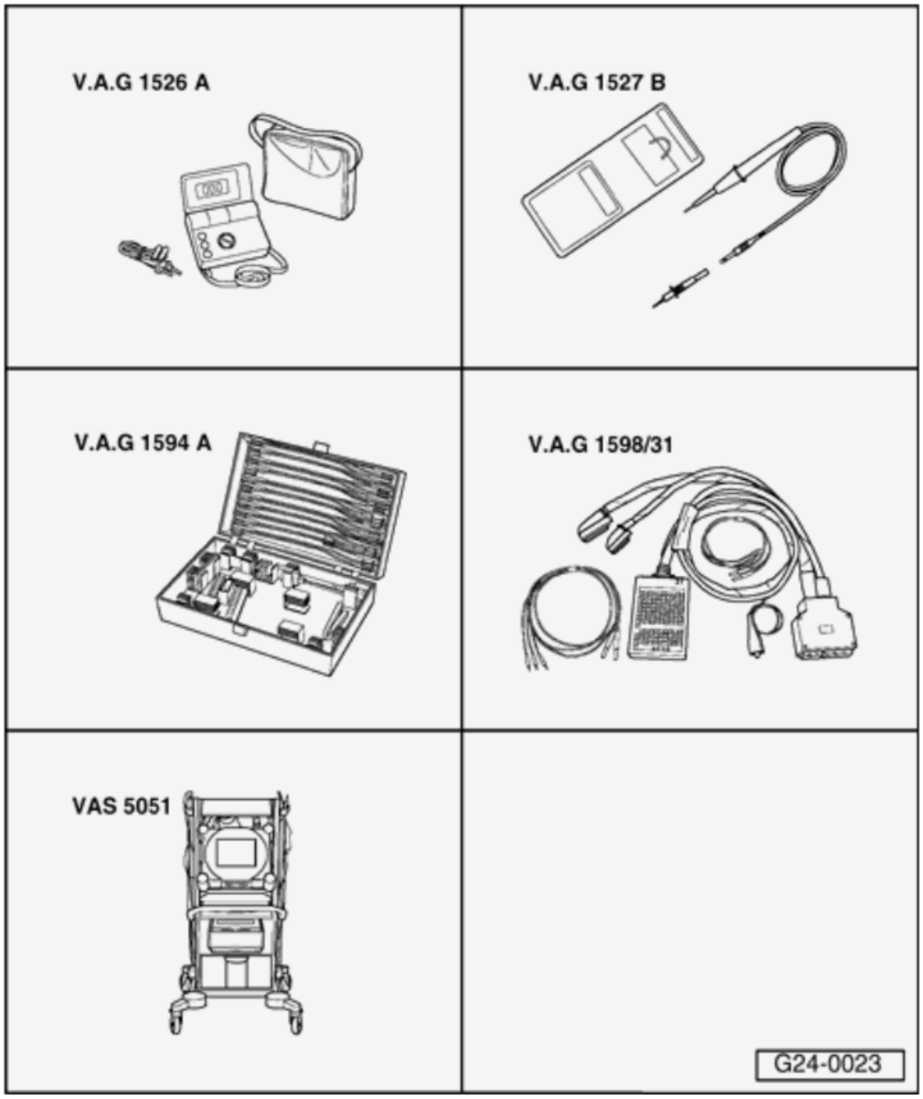

Fig. 303: Identifying Special Tools - Clutch Pedal Switch Check -F36-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

- VAS5051 with VAS5051/1

NOTE: **This signal is designed to prevent speed overshoots and jerkiness on switching from throttle open to throttle closed and vice versa when disengaging clutch. It is needed for the cruise control system.**

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

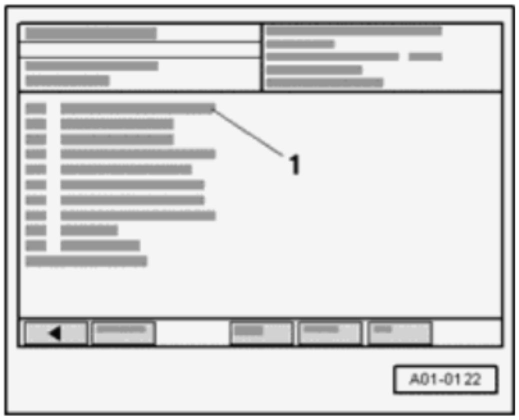

Fig. 304: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

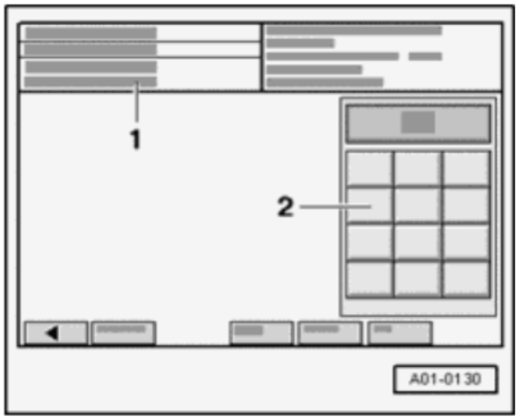

Fig. 305: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "066" for "display group number 066" in zone -2- and confirm entry by pressing -Q- button.

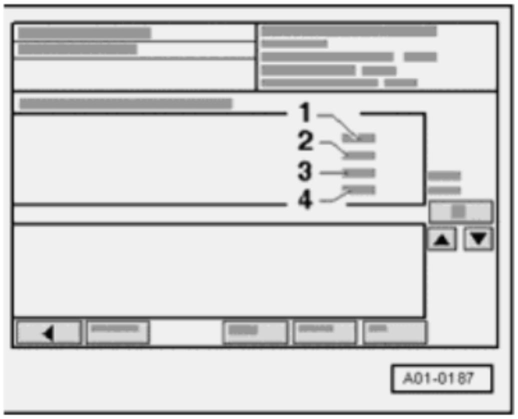

Fig. 306: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -2-.

	Display zones			
	1	2	3	4
Display group 066: Signals to engine control module				
Display	xxx km/h	**XXXXXXXX**	xxx km/h	XXXXXXXX
Display	ACTUAL speed	**Switch settings**	SPECIFIED speed	Switch settings
Range		**0 = off** **1 = on**		
Specif. value		**XXXXX0XX (clutch pedal (not pressed)**		
		XXXXX1XX (clutch pedal (pressed)		
Note:		**Value:** **X = no meaning**		

- Exit function "08 - Read measured value block" by pressing <-- button.

If the display is not as described:

Check switch

- Remove driver's storage compartment:

Refer to

- **68 - INTERIOR EQUIPMENT**

- **68 - INTERIOR EQUIPMENT** for BODY INTERIOR - CABRIOLET

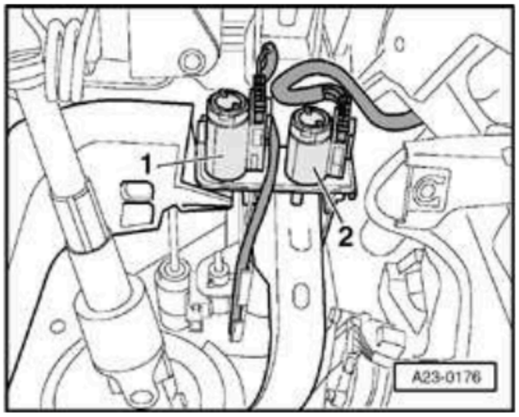

Fig. 307: Disconnecting Connector From Brake Light/Brake Pedal Switch -2-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector from clutch pedal switch -1-.

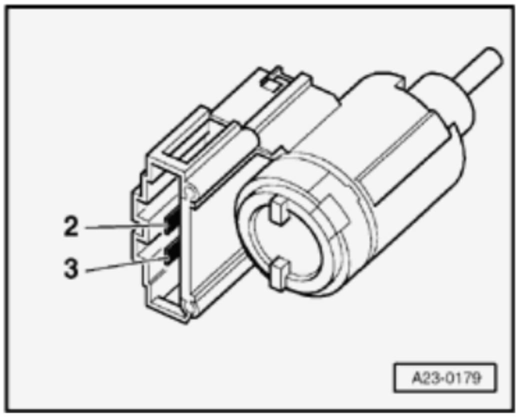

Fig. 308: Identifying Clutch Vacuum Vent Valve Switch -F36- Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 2 and 3 to measure resistance.

- Specified value: approx. 0 ohms

- Operate clutch pedal.

- Specified value: infinity ohms (no continuity)

If specified value is not obtained:

- Replace clutch pedal switch.

If specifications are obtained:

Check power supply

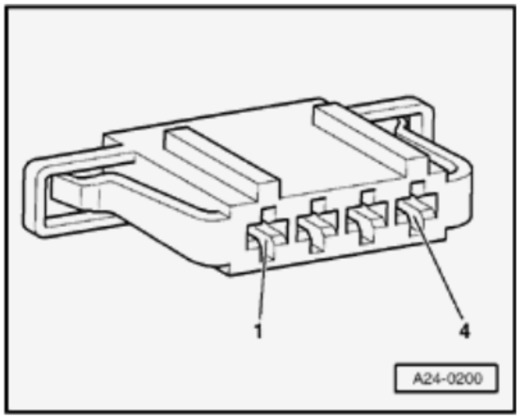

Fig. 309: Identifying 4-Pin Clutch Pedal Switch Terminals 1 & 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B as follows:

Connector Terminal	Measure to
3	Car body Ground point

- Switch ignition on.

- LED should illuminate.

If the LED does not illuminate:

- Check wiring for open circuit and service if necessary.

If the LED illuminates:

Check actuation

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

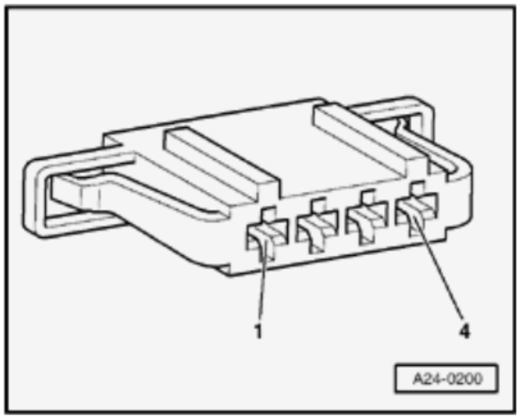

Fig. 310: Identifying 4-Pin Clutch Pedal Switch Terminals 1 & 2
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or Ground in following wiring connection:

Connector Terminal	Test box VAG1598/31 Socket
2	39

- Repair any open/short circuit as necessary.

Cruise Control System (CCS), testing

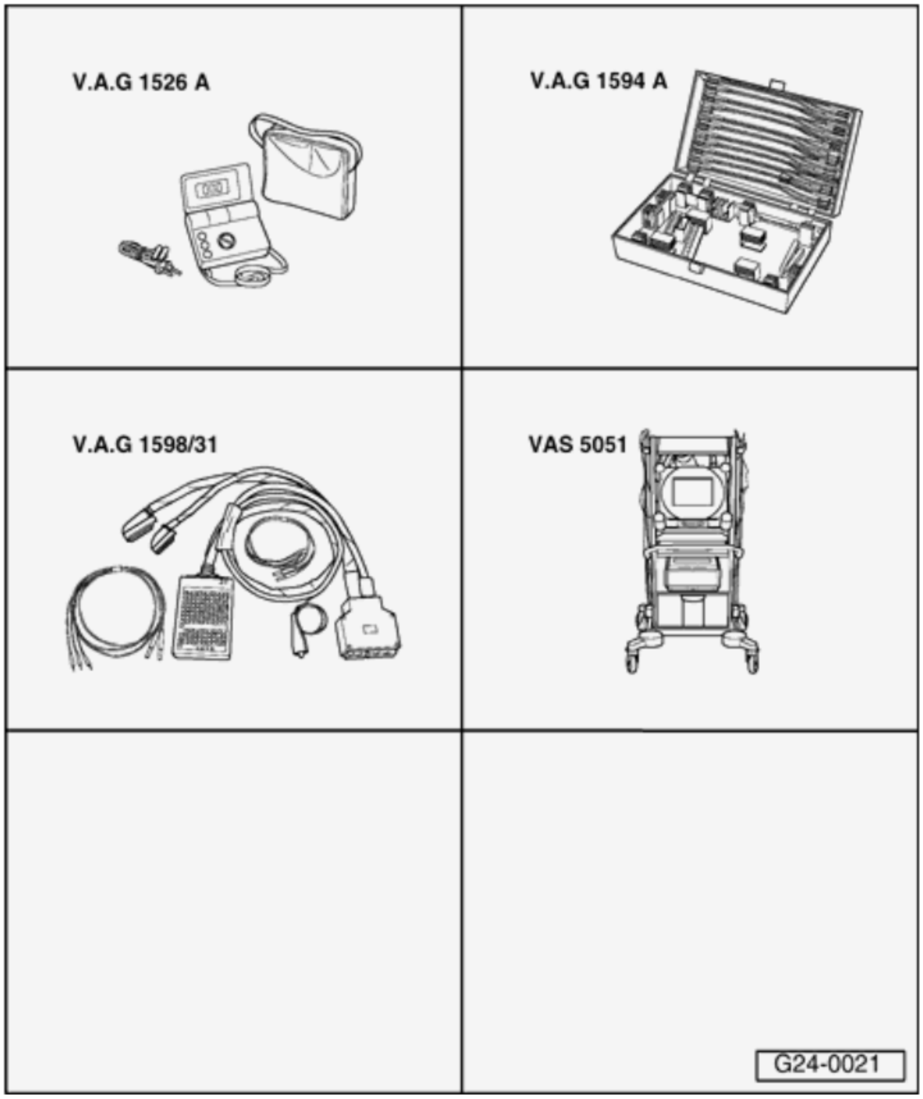

Fig. 311: Identifying Special Tools - Cruise Control System (CCS), Testing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

The Cruise Control System (CCS) has no components of its own (except for the operating switch). All cruise control functions are carried out by the engine control module.

Test sequence

WARNING: To avoid danger of accident when performing measurement and test drives, observe safety precautions. Refer to Safety precautions

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 -Engine electronics" in selection. Ignition must be switched on.

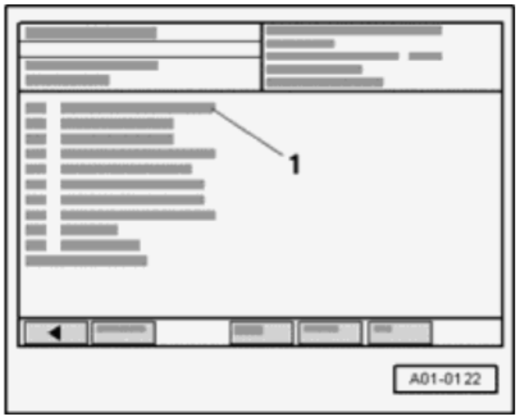

Fig. 312: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

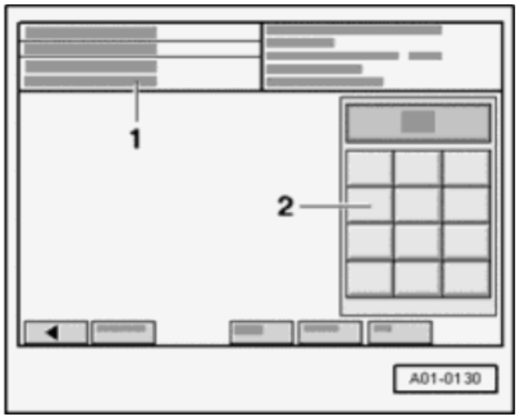

Fig. 313: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "066" for "display group number 066" in zone -2- and confirm entry by pressing -Q- button.

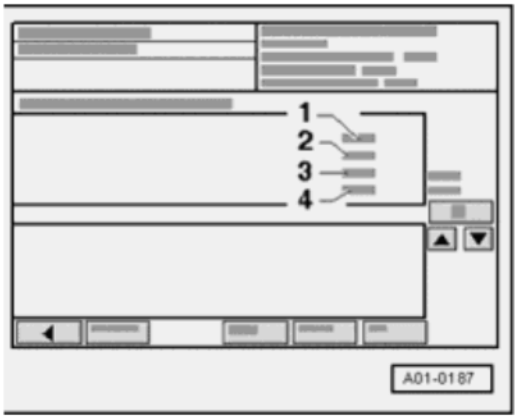

Fig. 314: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -2-.
- It must be ascertained by a road test whether switch positions are shown in display zone -4-.

	Display zones			
	1	2	3	4
Display group 066: Signals to engine control module				
Display	xxx km/h	**XXXXXXXX**	xxx km/h	**XXXXXXXX**
Display	ACTUAL speed	**Switch settings**	SPECIFIED speed	**Switch settings**
Range		**0 = off 1 = on**		**0 = off 1 = on**
Specif. value		**XXXX0XXX (if CCS not activated)**		**XXXXXXXX**
		XXXX1XXX (if CCS activated)		
Note:		**Specif. value**		Significance of 8-digit display. Refer to **Significance of 8-digit display in display zone 4**

- Exit function "08 - Read measured value block" by pressing <-- button.

If "0" appears in display zone 2 even with activated CCS:

- Connect VAG1598/31 test box to wiring harness for engine control module and also to engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Connect multimeter as follows to measure voltage:

Test box VAG1598/31 Socket	Measure to
38	Engine Ground

- Switch ignition on.

- Specification for CCS switched off: 0 V
- Specification for CCS switched on: approx. battery voltage

If the specified values are not obtained:

- Check for open circuit and short to positive or Ground in following wiring connections:

Test box VAG1598/31 Socket	Steering column electronics control module -J527- Terminal
38	Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair any open/short circuit as necessary.

Significance of 8-digit display in display zone 4

Switch position	Display zone 4							
CCS locked "OFF"	0	X	0	0	0	0	0	0
CCS locked "ON" (standby)	**1**	X	0	0	0	0	0	**1**
CCS keyed "OFF"	**1**	X	0	0	0	0	**1**	**1**
Tip down/decelerate	**1**	X	0	0	0	**1**	0	**1**
Tip up/accelerate	**1**	X	0	0	**1**	0	0	**1**
Set	**1**	X	0	**1**	0	0	0	**1**
Reactivation	**1**	X	**1**	0	0	0	0	**1**

If specifications in display zone 4 are not obtained:

- Check Cruise control switch -E45-.

AUXILIARY SIGNALS, CHECKING

Auxiliary signals, checking

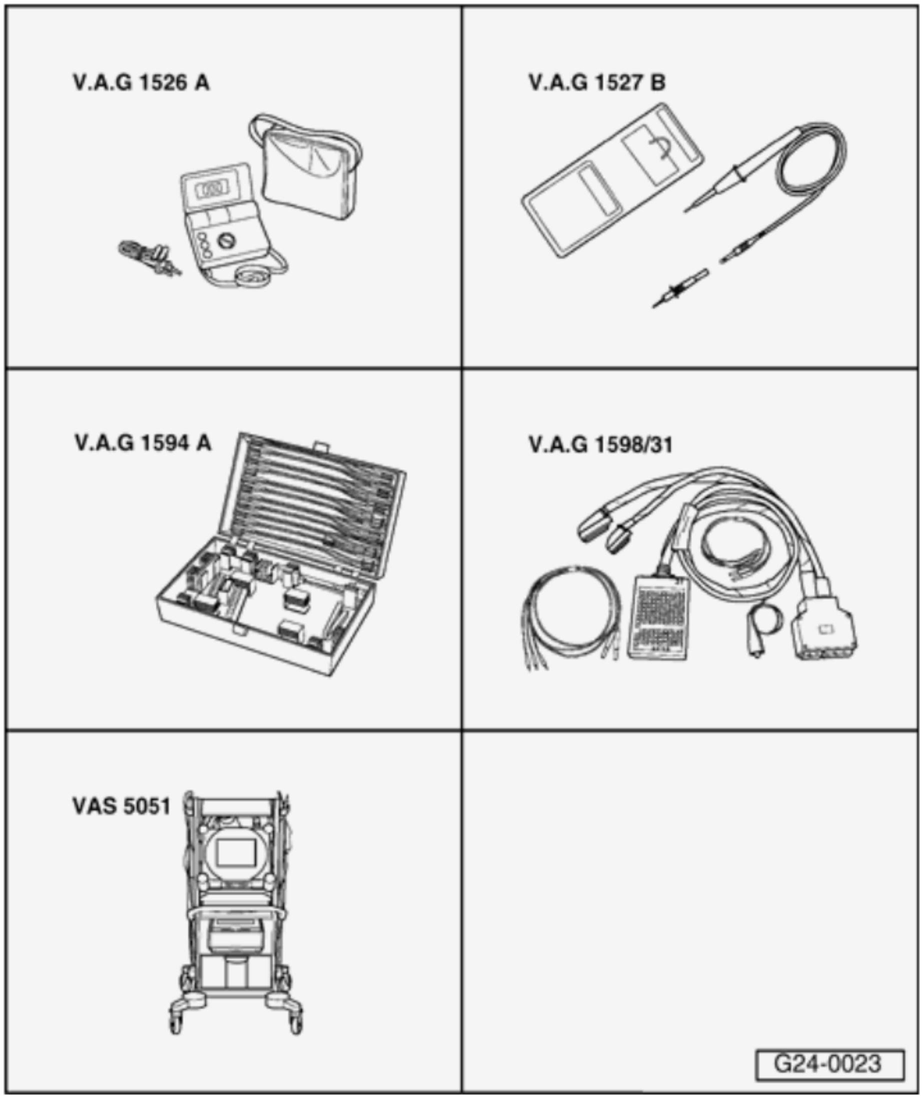

Fig. 315: Identifying Special Tools - Auxiliary Signals, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

- VAS5051 with VAS5051/1

Engine speed signal, checking

Vehicles with multitronic 01J:

NOTE: The engine speed signal is output at terminal 37 of the engine control module only in vehicles with multitronic 01J.

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Check for open circuit and short to positive or Ground in following wiring connections:

Test box VAG1598/31 Socket	Instrument cluster Terminal
37	. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Check CAN bus. Refer to **Data exchange between engine control module and other CAN-control modules, checking**.

Wiring for crash signal, checking

The engine control module receives the crash signal ("Crash cut-off was activated") from the airbag control module.

The airbag control module sends the crash signal to the engine control module (during an accident or if a final control diagnosis is carried out relating to the airbag system), the engine control module switches off the fuel pump, which stops the engine. It can however be restarted (e.g. to move vehicle out of danger area)

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Check for open circuit and short to positive or Ground in following wiring connections:

Test box VAG1598/31 Socket	Control module for Airbag -J234- Terminal
67	. Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Check Diagnostic Trouble Code (DTC) memory of airbag control module:

Data exchange between engine control module and other CAN-control modules, checking

NOTE:

- **Data is exchanged between individual control modules by means of a bus system.**
- **"CAN bus" is used to describe a system that transports and distributes data.**
- **The wires between the control modules that are used to transfer the data are known as signal wires.**
- **Data is transmitted via data wires in sequence, i.e. in a specific order to the connected control modules (e.g. engine RPM and accelerator pedal position).**

Testing the bus system

The DTC table instructed you to check the data exchange between the engine control module and CAN-compatible control modules.

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Ignition must be switched on.

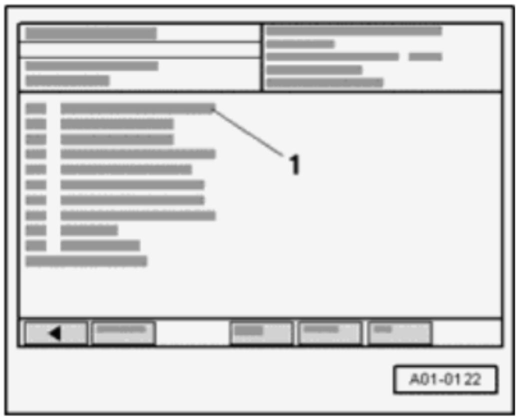

Fig. 316: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

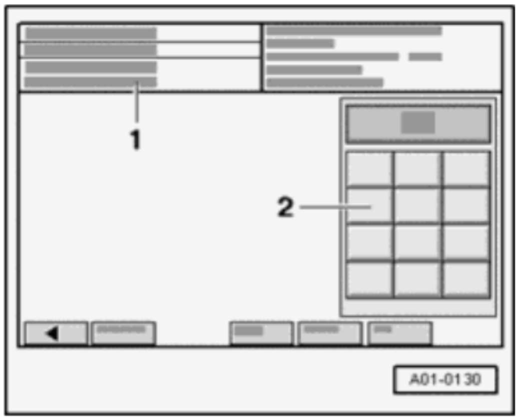

Fig. 317: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

NOTE: The measured value blocks 125 and 126 indicate CAN drive users.

- Enter "125" for "display group number 125" in zone -2- and confirm entry by pressing -Q- button.

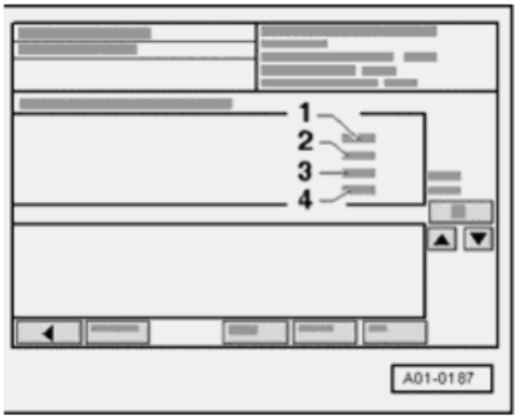

Fig. 318: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check displays in display zones -1- to -4-.

CAN-compatible control modules are displayed with the engine control module:

- No display: Engine control module not CAN-compatible
- Display 1: CAN-compatible control module is a data bus user
- Display 0: CAN able control module is not user of the Databus

- To change to display group 126, press the s button.
- Check same way with display group number 126.
- Exit function "08 - Read measured value block" by pressing <-- button.

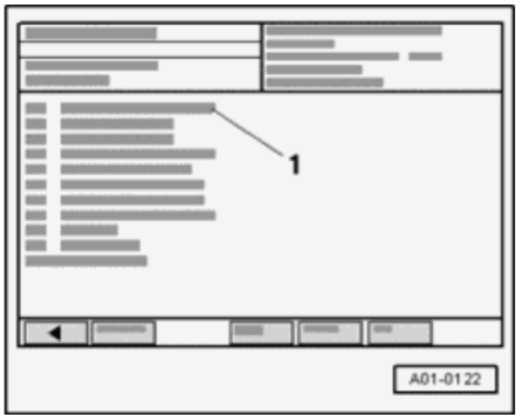

Fig. 319: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "06 - End output".

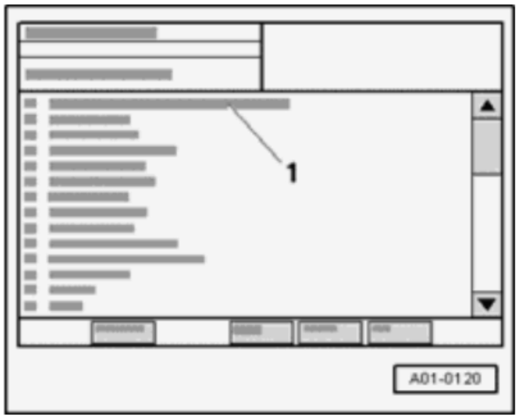

Fig. 320: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "00 - check DTC memory - whole system".

- The DTC memory is then checked for all systems in the vehicle which are capable of self-diagnosis

If a control module answers with its identification, the number of DTCs stored or "No malfunction detected" appears on the display.

Any system DTCs that are stored are displayed successively. The VAS5051 will then transmit the next address word.

If a DTC is displayed relating to "Data bus drive..." or "... CAN bus":

- Check that engine control module and other CAN-compatible control modules installed are suitable for this vehicle (part no. and code).

If the correct control modules are installed:

- Check that multiple connectors for control modules are properly seated.

If the multi-pin connectors are firmly seated:

- Check CAN bus system.

Checking a "two-wire bus system"

The communication between three or more control modules is carried out over a "two-line bus system".

- Evaluate DTCs stored in control modules.

NOTE: This helps to localize line malfunctions.

Example 1:

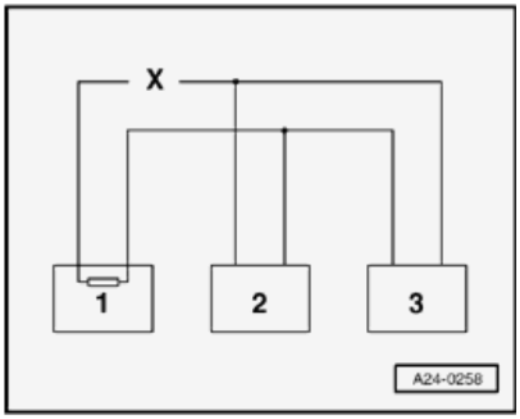

Fig. 321: Control Module 1 Not Communicating With Control Modules 2 And 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The DTCs stored in the DTC memories indicate that the control module 1 does not communicate with control modules 2 and 3.

Control module	DTCs stored in DTC memory
1	• No message from control module 2

	• No message from control module 3
2	• No message from control module 1
3	• No message from control module 1

- Switch ignition off.
- Disconnect control modules linked to one another via bus wires and check whether there is an open circuit between bus wires.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- If no DTC can be detected in bus lines exchange control module 1.

Example 2:

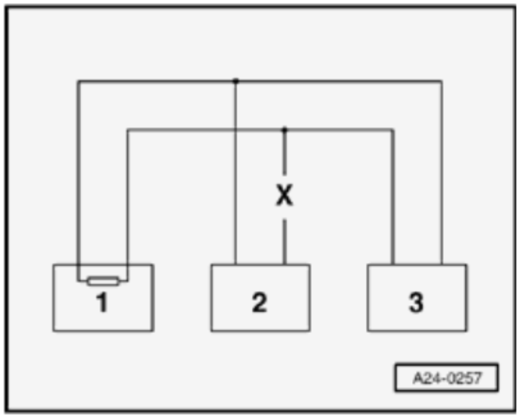

Fig. 322: Control Module 2 Not Communicating With Control Modules 1 And 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The DTCs stored in the DTC memories indicate that the control module 2 does not communicate with control modules 1 and 3.

Control module	DTCs stored in DTC memory
1	• No message from control module 2
2	• No message from control module 1 • No message from control module 3
3	• No message from control module 2

- Switch ignition off.
- Disconnect control modules linked to one another via bus wires and check whether there is an open circuit between bus wires.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- If no DTC can be detected in bus lines exchange control module 2.

Example 3:

The DTCs stored in the DTC memories indicate that sending or receiving is not possible in any of the control modules.

Control module	DTCs stored in DTC memory
1	• Data bus drive malfunction
2	• Data bus drive malfunction
3	• Data bus drive malfunction

- Switch ignition off.

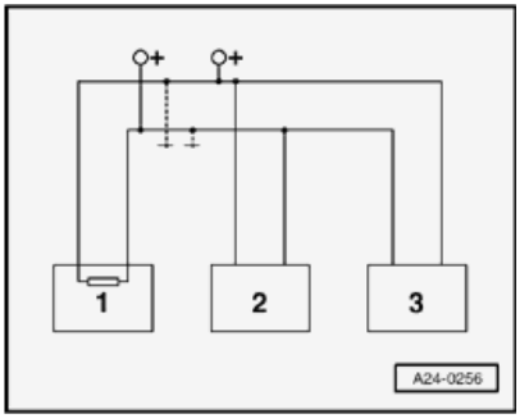

Fig. 323: Checking Bus Wires For Short Circuit To B+ Or Ground
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect control modules that are linked to one another by bus wires and check bus wires for short circuits to positive and Ground.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If cause of DTC "Data bus drive faulty" cannot be found in bus lines check whether one of the control modules is responsible for the malfunction.

Test requirements:

- Vehicle diagnosis, measurement and information system VAS5051 connected and vehicle On Board Diagnosis selected. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions**.

All the control modules that communicate via the CAN data bus are still disconnected. Ignition is switched off.

- Connect one control module.

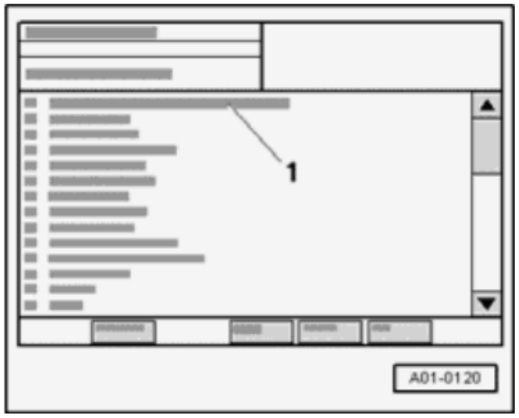

Fig. 324: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Switch ignition on.
- Select applicable vehicle system under -1-.
- Check and erase DTC memory in control module which has just been connected.
- Press <-- button.
- Under -1- select diagnostic function "06 - End output".
- Switch ignition off and then on again.
- Leave ignition switched on for 10 seconds. Then check DTC memory of control module that has just been connected, using scan tool.
- If DTC "Data bus drive faulty" is now indicated, replace control module which has just been connected.
- If DTC "Signal wire defective" is not read out, connect next control module and repeat procedure.

VACUUM DIAGRAM

Vacuum diagram

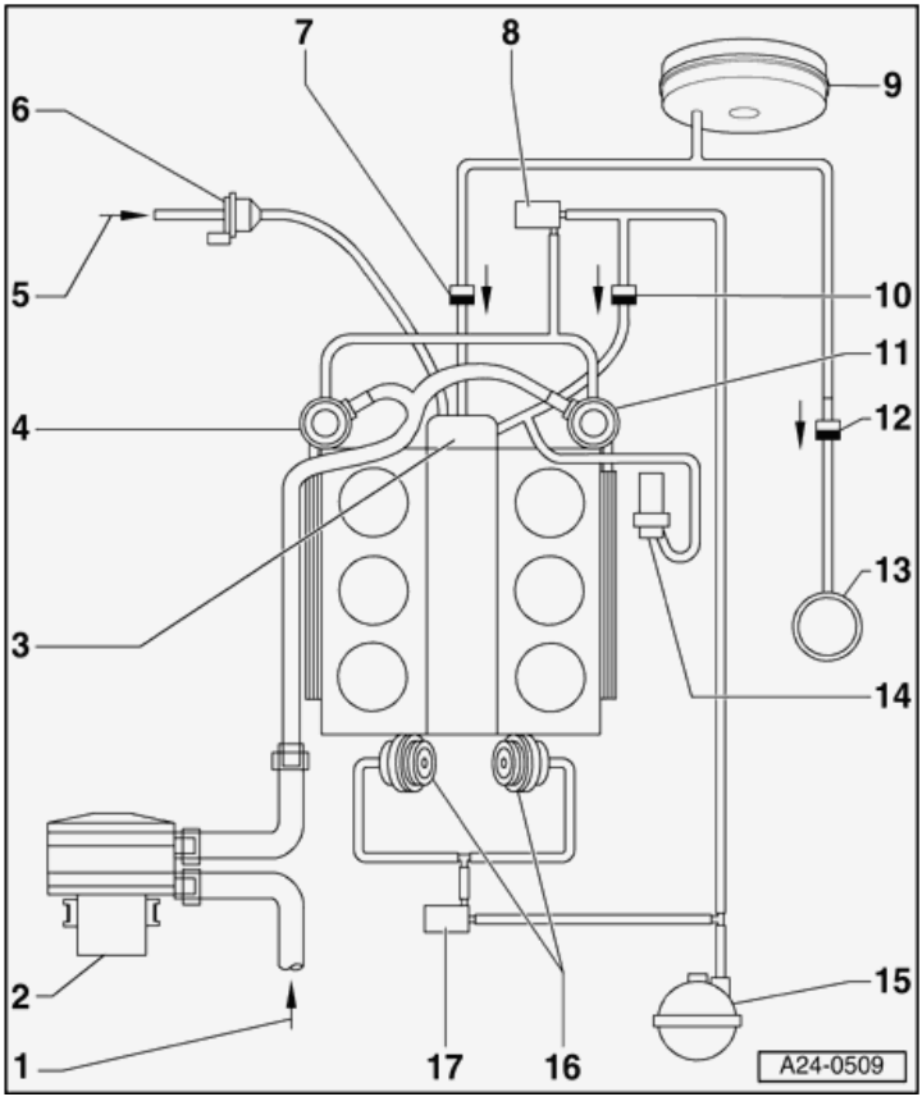

Fig. 325: Vacuum Diagram
Courtesy of VOLKSWAGEN UNITED STATES, INC.

1 - From air filter

2 - Secondary Air Injection (AIR) pump motor -V101-

3 - Throttle valve control module -J338-

4 - Combi valve for secondary air inlet, right

5 - From EVAP canister

6 - Evaporative Emission (EVAP) canister purge regulator valve -N80-

7 - Non-return valve

- Between intake manifold and brake servo
- Installation position: as shown in **Fig. 325**, arrow faces in direction of flow

8 - Secondary Air Injection (AIR) solenoid valve -N112-

- Location: On retainer plate for solenoid valves at rear of engine

9 - Brake servo

10 - Non-return valve

- Between intake manifold and solenoid valves
- Installation position: as shown in **Fig. 325**, arrow faces in direction of flow

11 - Combi valve for secondary air inlet, left

12 - Non-return valve

- Between brake servo pump and brake servo
- For vehicles with automatic transmission
- Installation position: as shown in **Fig. 325**, arrow faces in direction of flow

13 - Brake system vacuum pump -V192-

- For vehicles with automatic transmission

14 - Fuel pressure regulator

15 - Vacuum reservoir

- Location: In front left wheel housing beneath wheel housing liner

16 - Vacuum actuator

17 - Intake manifold change-over valve -N156-

28 IGNITION/GLOW PLUG SYSTEM

IGNITION SYSTEM, CHECKING

General notes on ignition system

- Switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.
- A voltage of at least 12.7 V is necessary for satisfactory functioning of the electrical components.
- During some of the tests, a malfunction may be recognized and stored by the control module. At the end of all tests and repairs, the DTC memory should be checked and, erased.
- If the engine starts and then stops after malfunction search, repair or tests on components, because the immobilizer is blocking the engine control module. The DTC memory must then be checked and, if necessary, the control module adapted.

WARNING:

- **Safety precautions before disconnecting battery:**

Refer to

- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL**
- **27 BATTERY, STARTER, GENERATOR, CRUISE CONTROL for ELECTRICAL EQUIPMENT, CABRIOLET**

- **Always switch ignition off before disconnecting or connecting battery. Failure to do so may damage a control module.**

Safety precautions

To prevent injuries to persons and/or damage to the fuel injection and ignition system, observe the following:

- Do not touch or disconnect ignition wiring when the engine is running or at starting speed.
- The ignition must be switched off before connecting or disconnecting ignition system wiring. This also applies to high-voltage cables and measuring instrument leads.
- In order to run engine at starting speed without actually starting it (for example, in order to test compression), unplug connector from the output stage of the ignition coils and also the connectors on the injectors.
- In the case of some tests, a DTC may be recognized and stored by the control module. At the end of all tests and repairs, the DTC memory should be checked and, if necessary, erased. After erasing the DTC memory the readiness code must be produced. Refer to **Readiness code, generating** .

- Always switch off the ignition before washing the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.

Technical data for ignition system

Engine codes	**AVK (3.0 L/5V/162 kW-engine)**	**BGN (3.0 L/5V/162 kW-engine)**
Idle speed Engine speed cannot be adjusted, it is regulated by idle stabilization	700 to 800 RPM1)	700 to 800 RPM1)
Engine speed (RPM) limitation Via fuel injector shut-off	approx. 6800 RPM	approx. 6800 RPM
Ignition timing is determined in the control module It is not possible to adjust the ignition timing		
Ignition system	Individual coil ignition system with 6 ignition coils (power output stages integrated) that are connected directly to spark plugs via the ignition cables.	Individual coil ignition system with 6 ignition coils (power output stages integrated) that are connected directly to spark plugs via the ignition cables.
Spark plugs 2)	Tightening torque 30 Nm	Tightening torque 30 Nm
Ignition sequence	1-4-3-6-2-5	1-4-3-6-2-5

1) Depending on engine oil temperature/transmission oil temperature (automatic transmission 01J) an engine speed increase up to 980 RPM is possible.

2) Current values:

Refer to

- **01 - MAINTENANCE**
- **01 - MAINTENANCE** for MAINTENANCE PROCEDURES - CABRIOLET

Ignition coils with output stages, checking

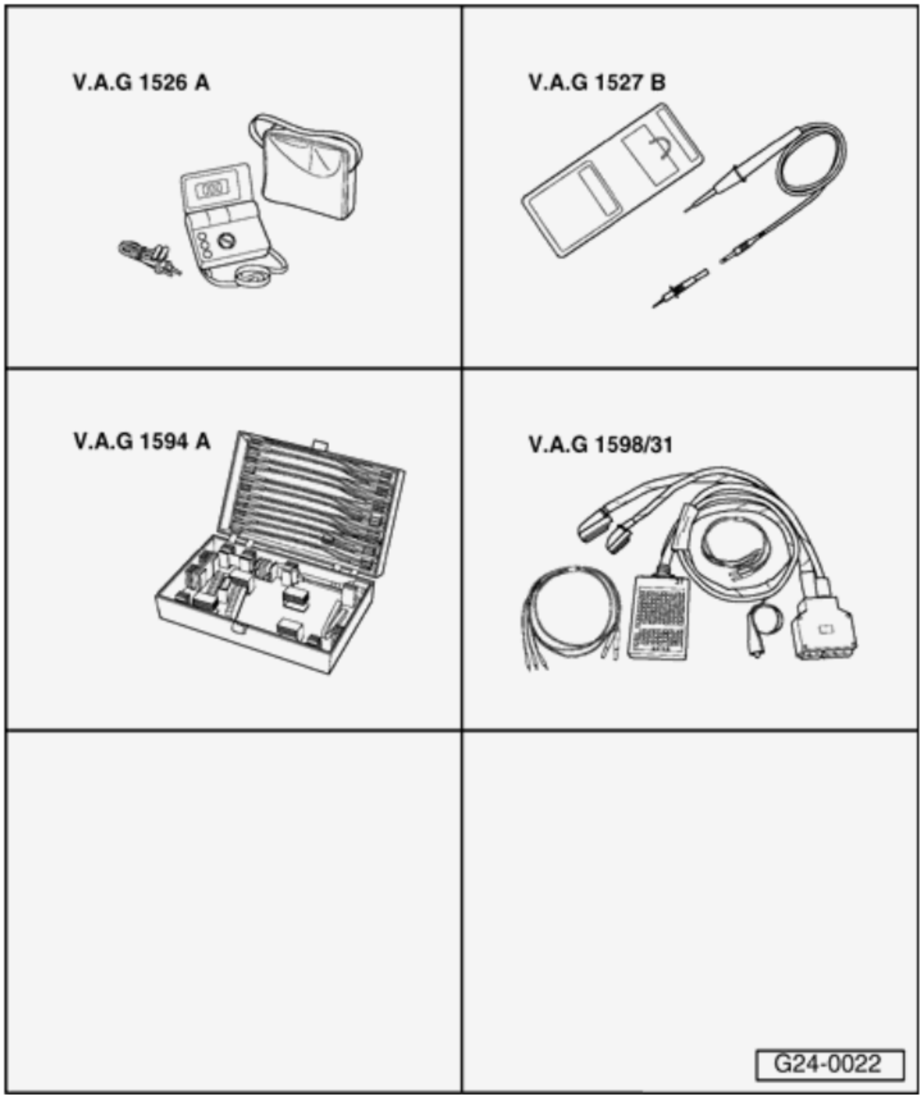

Fig. 326: Identifying Special Tools - Ignition Coils With Output Stages, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

Test sequence

NOTE: The ignition coil and the output stage are combined in a common component.

Identify an inoperative or misfiring cylinder as follows:

- Test misfire detection. Refer to **Misfire detection, checking**.

If misfires are detected:

- Continue checking indicated cylinder if faulty cylinder has been detected.

If no misfires were detected:

- Disconnect connectors from injectors in sequence with engine running, and observe how engine runs.

or

- Compare spark plugs of all cylinders with each other and check for carbon on electrodes.

If the faulty cylinder has been identified:

- Replace spark plug of faulty cylinder with one from another cylinder.

If the malfunction moves with the spark plug:

- Replace spark plug.

If the malfunction remains in the same cylinder:

- Replace ignition coil from faulty cylinder with one from another cylinder.

If the malfunction moves with the ignition coil:

- Replace ignition coil.

Test Ground connection

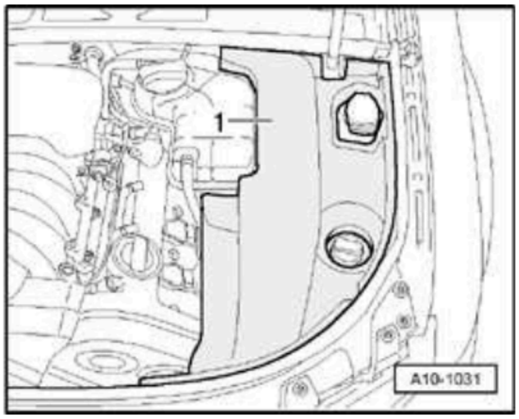

Fig. 327: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect cover -1- on left in engine compartment.

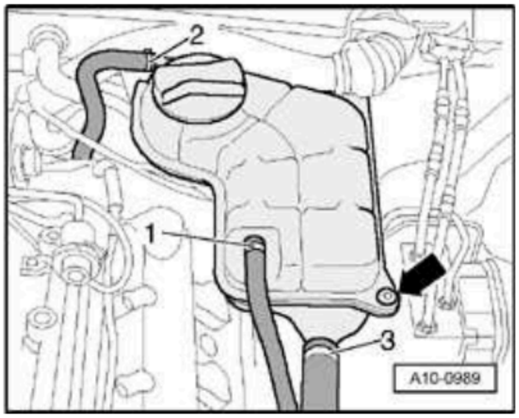

Fig. 328: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt coolant expansion tank (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- on bottom of expansion tank.
- Lay coolant expansion tank with connected coolant hoses -1- to -3- aside.

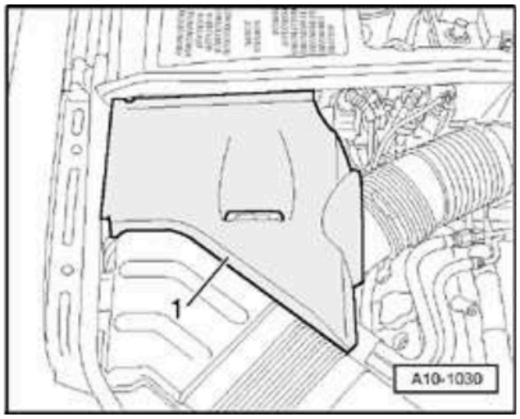

Fig. 329: Removing Cover In Engine Compartment (Right Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect cover -1- on right in engine compartment.

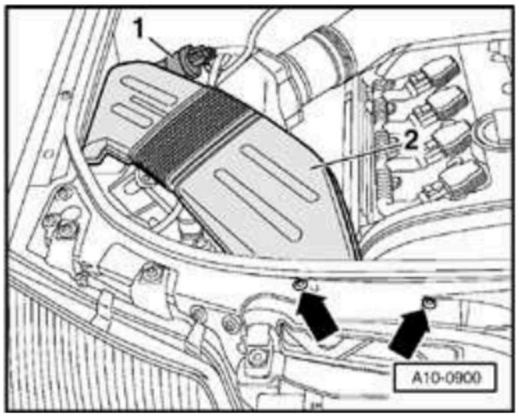

Fig. 330: Evaporative Emission Canister Purge Regulator Valve N80 And Air Duct
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows).
- Disconnect solenoid valve for Evaporative Emission (EVAP) canister purge -N80- -1- from air duct.
- Remove air duct -2-.

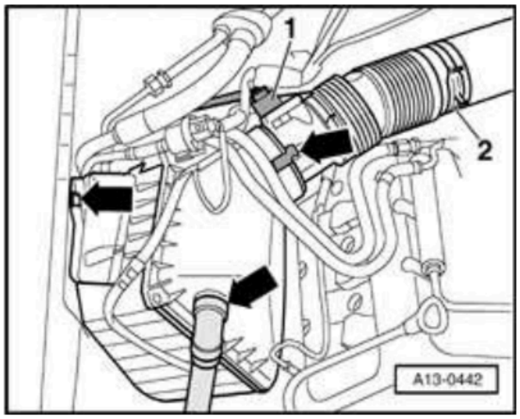

Fig. 331: Removing Air Filter Housing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove air filter housing (arrows).
- Disconnect connector -1- at mass air flow sensor.
- Remove air duct hose -2- together with mass air flow sensor.

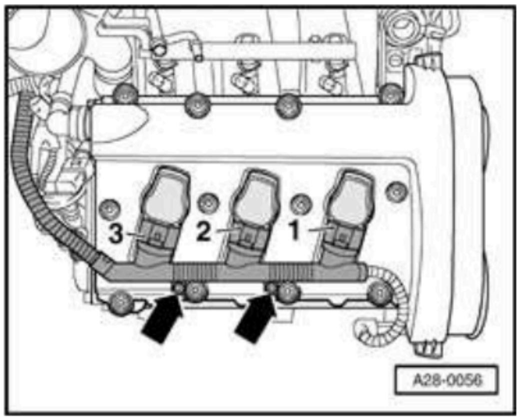

Fig. 332: Removing Bolts On Right Cylinder Head & Disconnecting 4-Pin Connectors On Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on right cylinder head.
- Disconnect 4-pin connectors -1- to -3- on ignition coils.

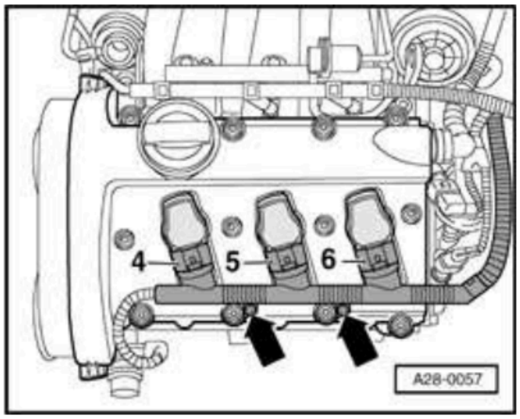

Fig. 333: Removing Bolts On Left Cylinder Head & Disconnecting 4-Pin Connectors On Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on left cylinder head.
- Disconnect 4-pin connectors -4- to -6- on ignition coils.

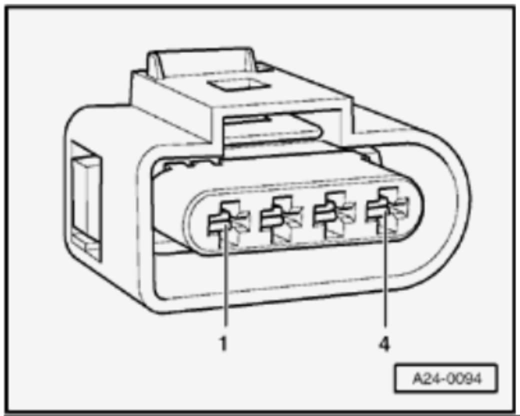

Fig. 334: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B as follows:

Connector Terminal	Measure to
2	Battery positive
4	Battery positive

- LED should illuminate.

If the LED does not illuminate:

- Check wiring connections.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

If the LED illuminates:

Checking power supply

Test requirements:

- Fuses for engine electronics OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

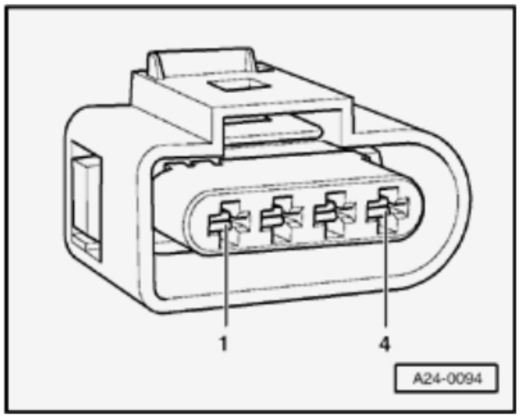

Fig. 335: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector	Measure to

Terminal	
1	Engine ground

- Switch ignition on.

- Specified value: approx. battery voltage

If specified value is attained:

- Check actuation of power output stages. Refer to **Checking actuation of power output stages**.

If specified value is not attained:

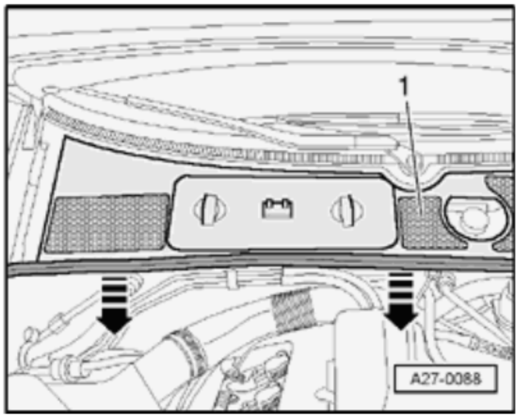

Fig. 336: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull off rubber seal of plenum chamber cover.
- Remove plenum chamber cover -1- toward front (arrows).

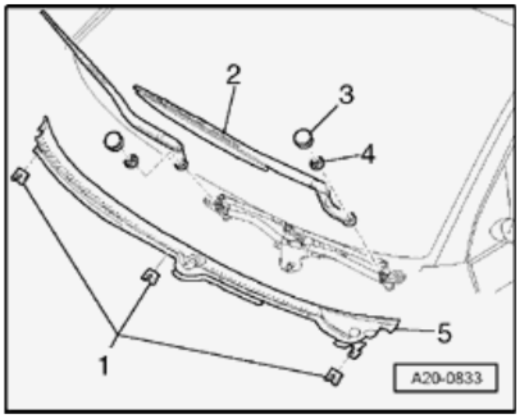

Fig. 337: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both trim caps -3- with a screwdriver.

- Undo hex nuts -4- a few turns.
- Release wiper arms -2- from pivot shaft by tilting them slightly.
- Remove hex nuts completely and remove wiper arms.

- Disconnect retaining clips -1- and remove air cowl grille -5-.

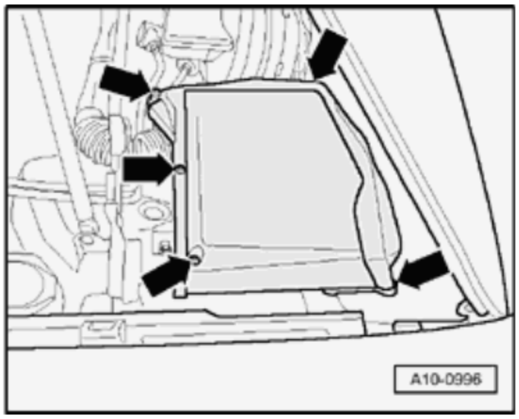

Fig. 338: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for electronics box (plenum chamber) (arrows).

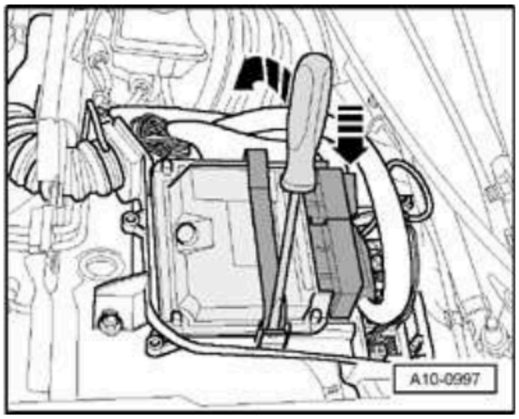

Fig. 339: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lift off engine control module retaining clip using a screwdriver (arrow) and move control module to side.
- If installed, unclip transmission control module retaining clip and place control module on one side.

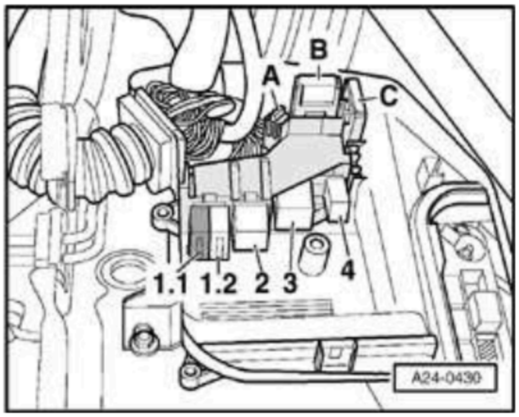

Fig. 340: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect power supply relay -2-.
- Perform following tests (marked with dots):

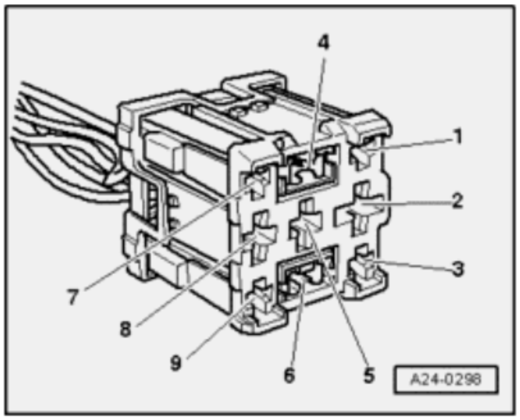

Fig. 341: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check the wiring of relay carrier, electronics box, plenum chamber, position 2, terminal 8, to connector of ignition coil terminal 1.
- Check power supply relay for Motronic Engine Control Module (ECM) power supply relay -J271-. Refer to **Motronic Engine Control Module (ECM) power supply relay -J271-, checking**.

Checking actuation of power output stages

- Connectors disconnected from ignition coils

- Disconnect connectors from all injectors.

NOTE: **It is important to make sure that no fuel is injected during the test, as this would damage the catalytic converter. The connectors on the injectors must be disconnected.**

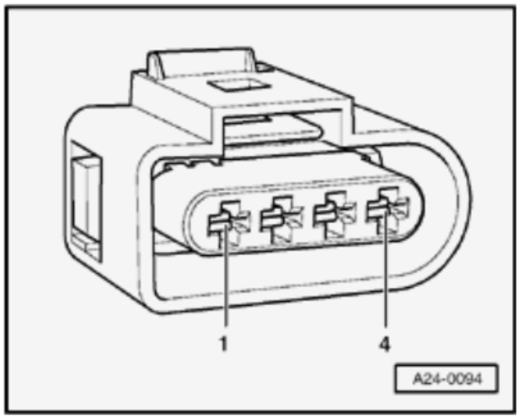

Fig. 342: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B to terminals 2 and 3 of connector.
- Operate starter briefly.

- LED test light should flash (very brief flashes).

If LED does not flash:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

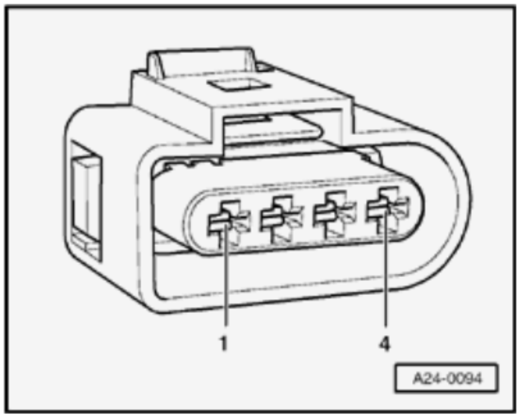

Fig. 343: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
3 (cyl. 1)	102
3 (cyl. 2)	110
3 (cyl. 3)	94

3 (cyl. 4)	103
3 (cyl. 5)	111
3 (cyl. 6)	95

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace common component ignition coil with power output stage.

Motronic Engine Control Module (ECM) power supply relay -J271-, checking

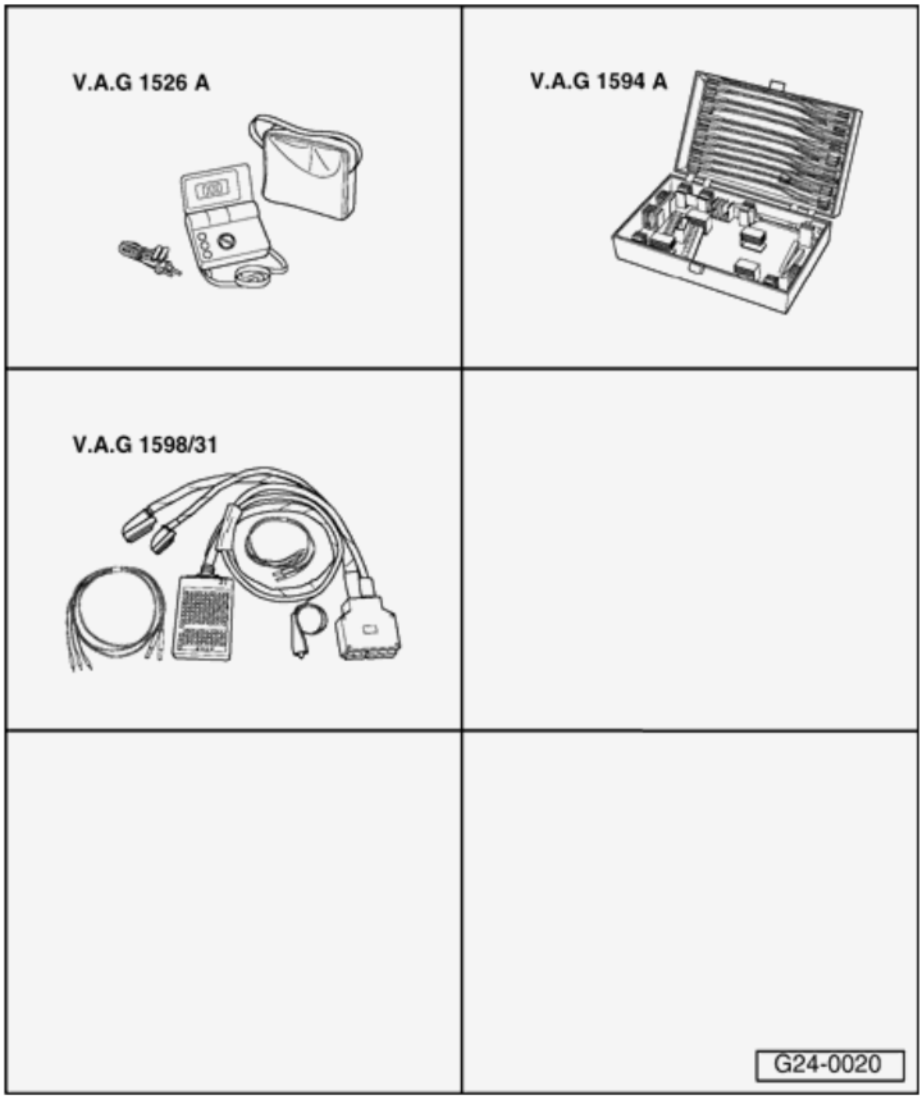

Fig. 344: Identifying Special Tools - Motronic Engine Control Module (ECM) Power Supply Relay -J271-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31

NOTE: The Motronic engine control module (ECM) power supply relay -J271- supplies the ignition coils with output stages as well as the engine control module on Pin 121 with power.

Test sequence

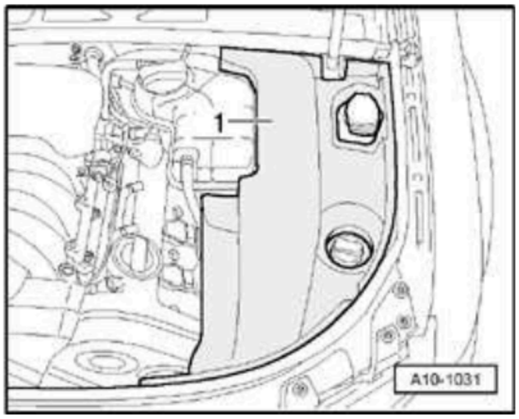

Fig. 345: Removing Cover In Engine Compartment (Left Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect cover -1- on left in engine compartment.

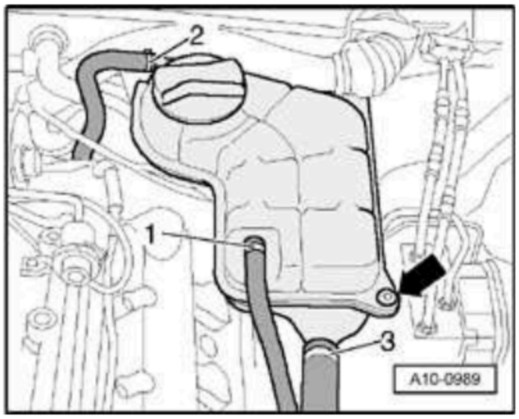

Fig. 346: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Unbolt coolant expansion tank (arrow).
- Disconnect electrical wiring to Engine Coolant Level (ECL) warning switch -F66- on bottom of expansion tank.

- Lay coolant expansion tank with connected coolant hoses -1- to -3- aside.

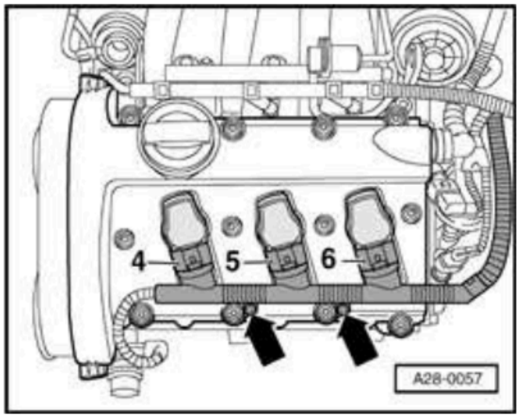

Fig. 347: Removing Bolts On Left Cylinder Head & Disconnecting 4-Pin Connectors On Ignition Coils
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove bolts (arrows) on left cylinder head.
- Disconnect 4-pin connectors -4- to -6- on ignition coils.

NOTE: For further testing, the multimeter is attached to an ignition coil connector.

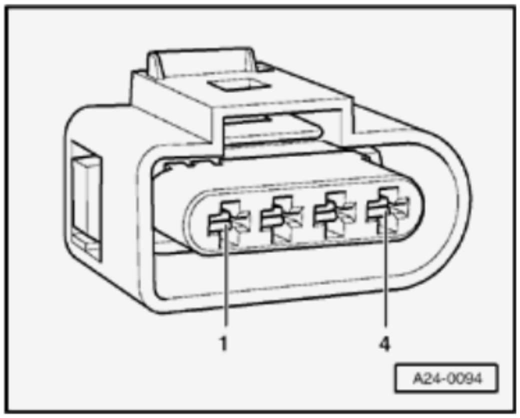

Fig. 348: Identifying Connector Terminals 1 And 4
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage.

Connector Terminal	Measure to
1	Engine ground

- Switch ignition on.

- Specified value: approx. battery voltage

If specified value is not attained:

- Switch ignition off.
- Pull off rubber seal of plenum chamber cover.

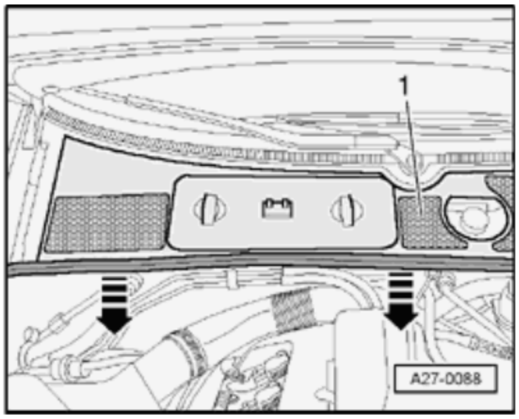

Fig. 349: Identifying Plenum Chamber Cover & Removing Rubber Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove plenum chamber cover -1- toward front (arrows).

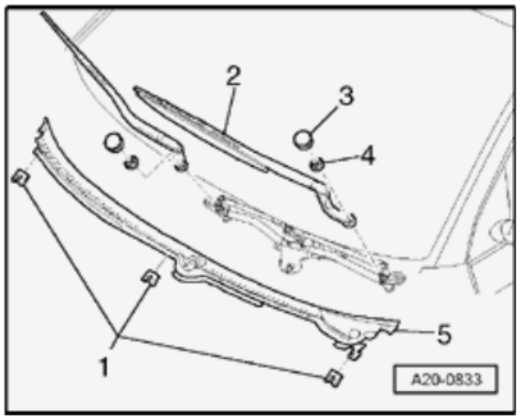

Fig. 350: Removing Securing Clips And Cowl
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pry off both trim caps -3- with a screwdriver.
- Undo hex nuts -4- a few turns.
- Release wiper arms -2- from pivot shaft by tilting them slightly.
- Remove hex nuts completely and remove wiper arms.

- Disconnect retaining clips -1- and remove air cowl grille -5-.

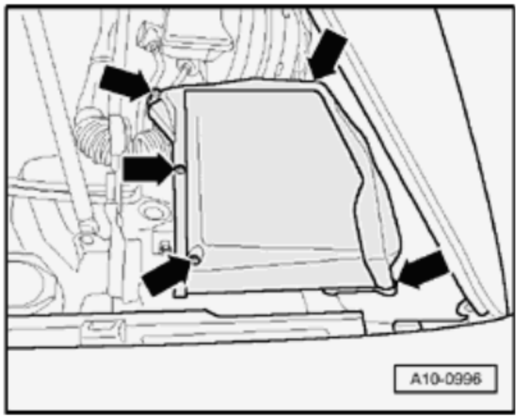

Fig. 351: Removing Screws And Cover From E-Box In Plenum Chamber
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove cover for electronics box (plenum chamber) (arrows).

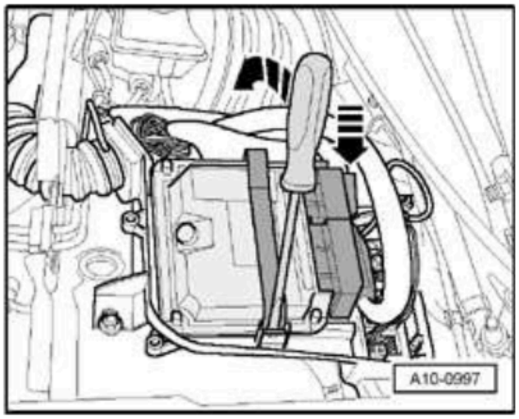

Fig. 352: Using Screwdriver To Remove Retainer Bar And Engine Control Module (ECM) J623
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Lift off engine control module retaining clip using a screwdriver (arrow) and move control module to side.
- If installed, unclip transmission control module retaining clip and place control module on one side.

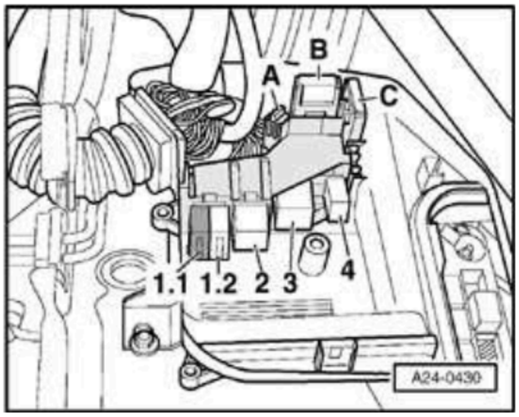

Fig. 353: Removing Motronic Engine Control Module (ECM) Power Supply Relay J271 From E-Box
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect power supply relay -2-.

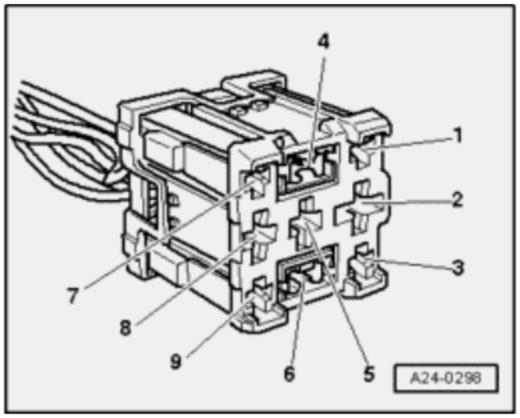

Fig. 354: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit in following wiring according to wiring diagram:

Relay carrier in electronics box, plenum chamber, position 2 Terminal	Connection of ignition coils Terminal
8	1

- Repair open circuit, if necessary.

If no wiring malfunction is detected:

- Check voltage supply of Motronic Engine Control Module (ECM) power supply relay -J271-. Refer to **Checking power supply**.
- Check actuation of Motronic Engine Control Module (ECM) power supply relay -J271-. Refer to **Checking actuation**.

Checking power supply

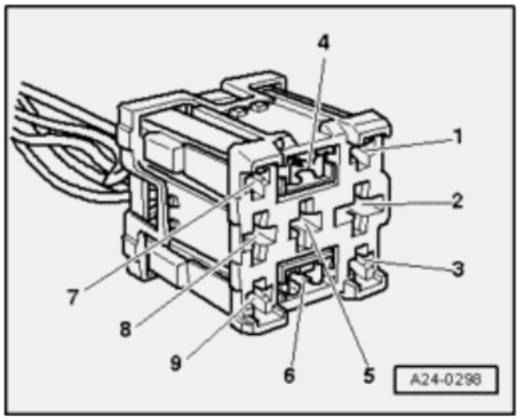

Fig. 355: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage.

Relay carrier in electronics box, plenum chamber, position 2 Terminal	Measure to
1	Engine ground
2	Engine ground

- Specified value: approx. battery voltage

If specified value is not attained:

- Check wiring connections.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

Checking actuation

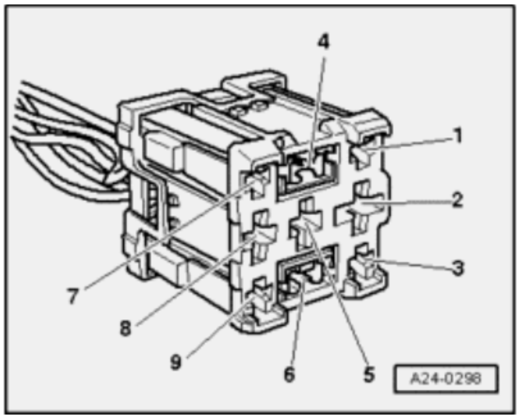

Fig. 356: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage.

Relay carrier in electronics box, plenum chamber, position 2 Terminal	Measure to
4	Battery positive

- Switch ignition on.

- Specified value: approx. battery voltage

If specified value is not attained:

- Switch ignition off.
- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

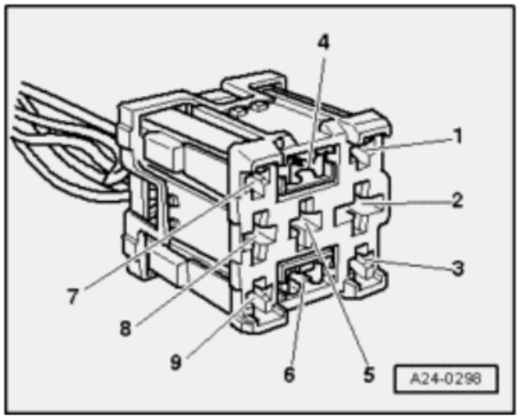

Fig. 357: Identifying Secondary Air Pump Relay Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or ground in following wiring connection:

Relay carrier in electronics box, plenum chamber, position 2 Terminal	Test box V.A.G 1598/31 Socket
4	23

- Repair any open/short circuit as necessary.

If no malfunction is found:

- Replace Motronic Engine Control Module (ECM) power supply relay -J271-.

Engine speed (RPM) sensor -G28-, checking

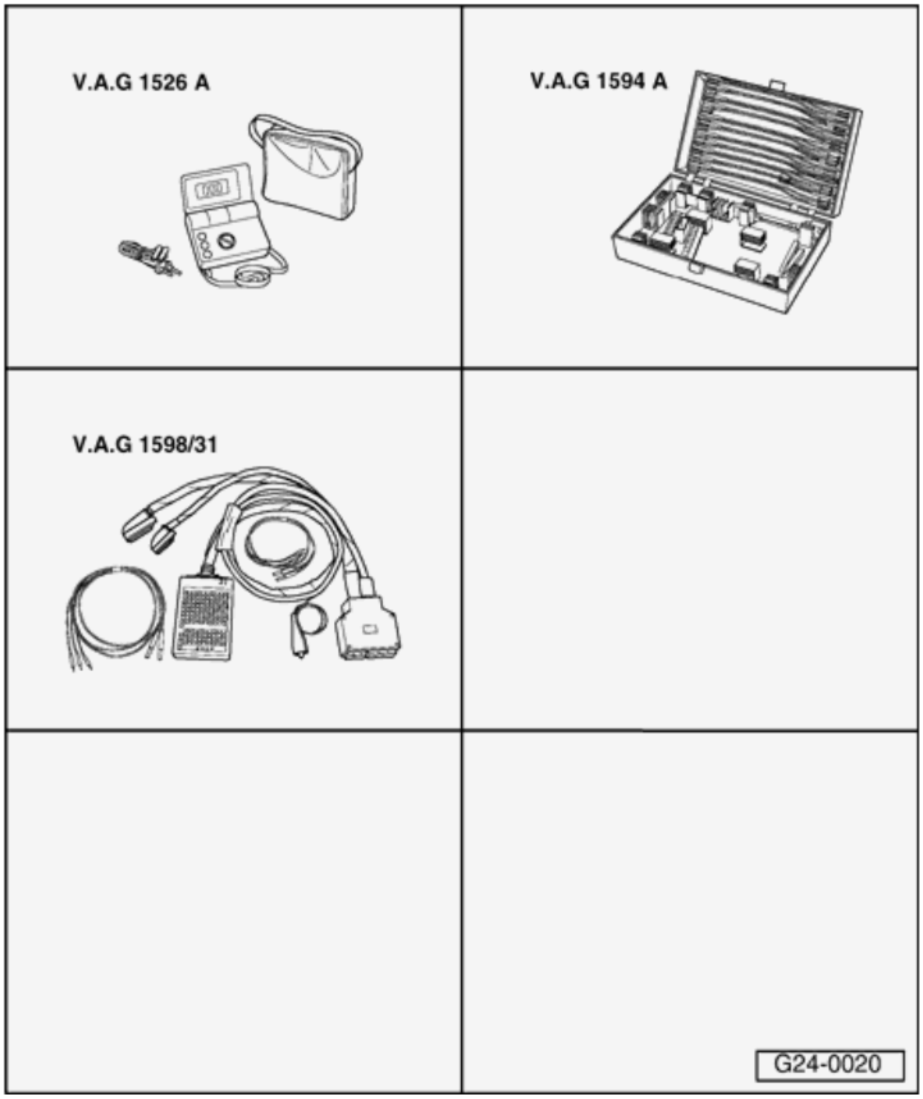

Fig. 358: Identifying Special Tools - Engine Speed (RPM) Sensor -G28-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31

NOTE: **The engine speed sensor is a combined speed sensor and reference mark sensor. The engine cannot be started without a signal from the Engine speed (RPM) sensor -G28-. If the signal from the Engine speed (RPM) sensor -G28- fails while the engine is running, the engine will cut out immediately.**

Test sequence

- Before performing test, make sure that sensor is correctly installed and firmly seated.
- Disconnect connector to engine speed sensor. See **Fig. 102**.

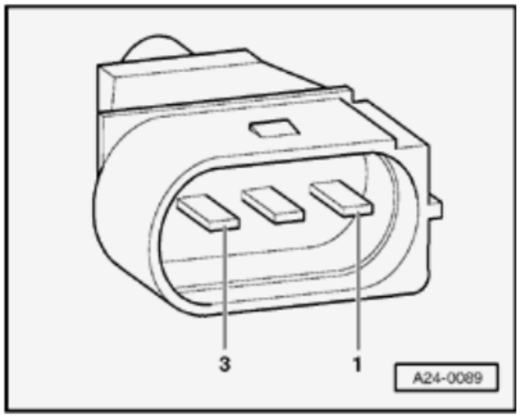

Fig. 359: 3-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 2 and 3 to measure resistance.

- Specified value: 730 to 1000 ohms

NOTE: The resistance value of the engine speed sensor is associated with a temperature of 20°C. The resistance increases if the temperature increases.

If specified value is not attained:

- Install a new engine speed sensor.

If specified value is attained:

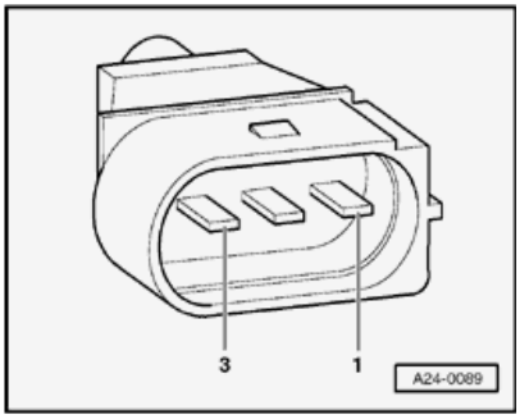

Fig. 360: 3-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals 2 and 1 (screen) and 3 and 1 (screen) to measure resistance.

- Specified value: each case infinity ohms (no continuity)

If specified value is not attained:

- Install a new engine speed sensor.

If specified value is attained:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

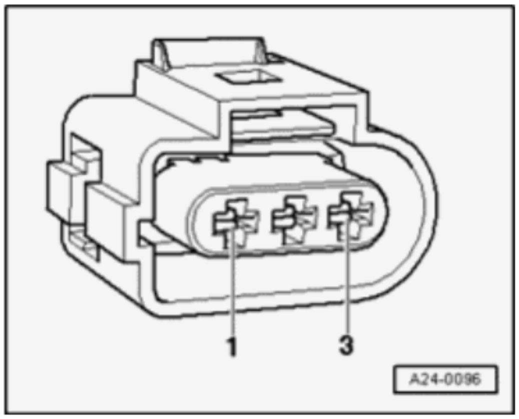

Fig. 361: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
1 (screening)	108
2 (ground)	90
3 (signal)	82

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Intake Air Temperature (IAT) sensor -G42-, checking

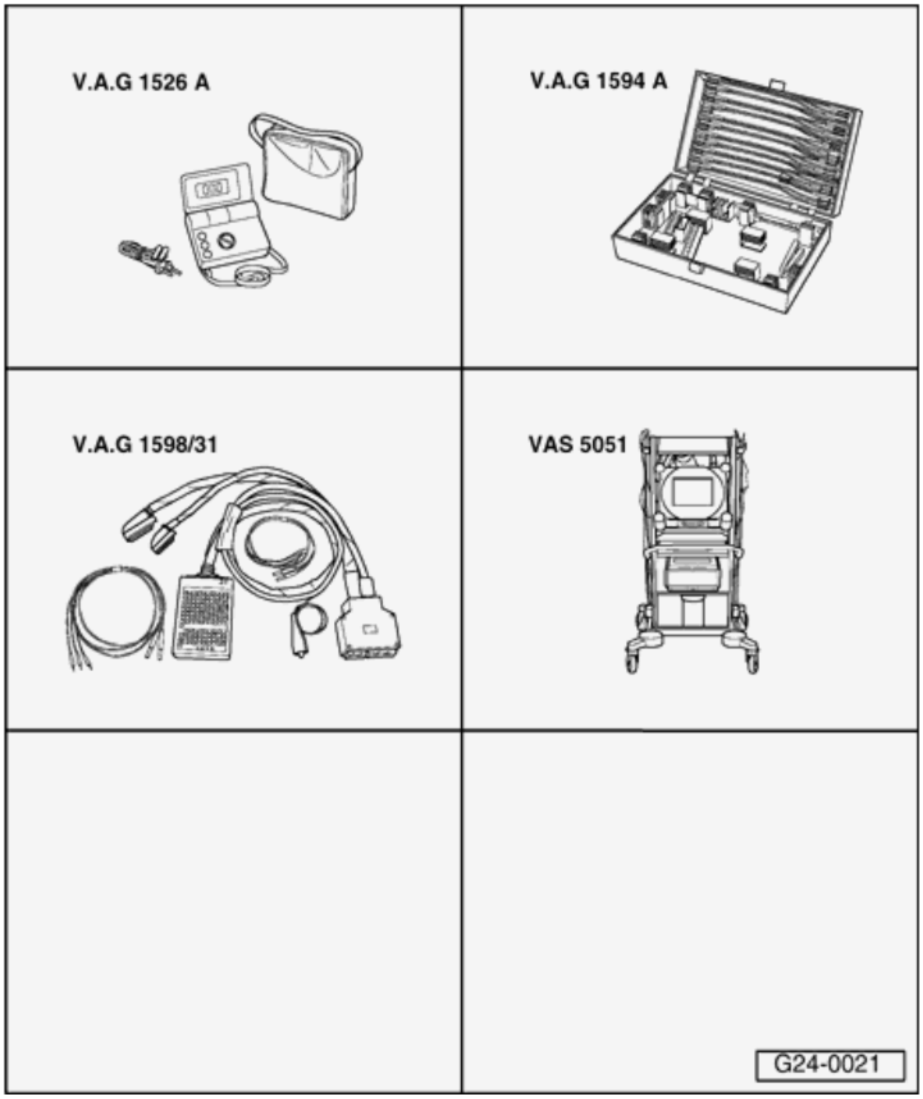

Fig. 362: Identifying Special Tools - Intake Air Temperature (IAT) Sensor -G42-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

NOTE: **The Intake Air Temperature (IAT) sensor -G42- is integrated in the Mass Air Flow (MAF) sensor -G70-.**

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

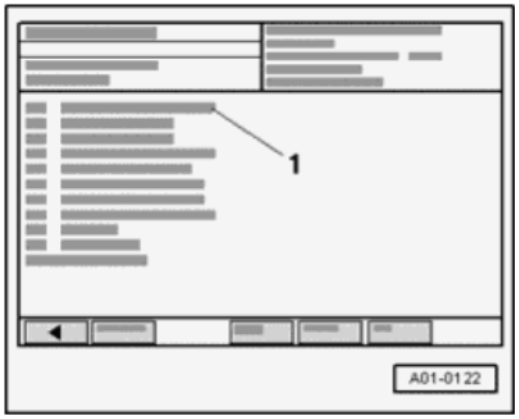

Fig. 363: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

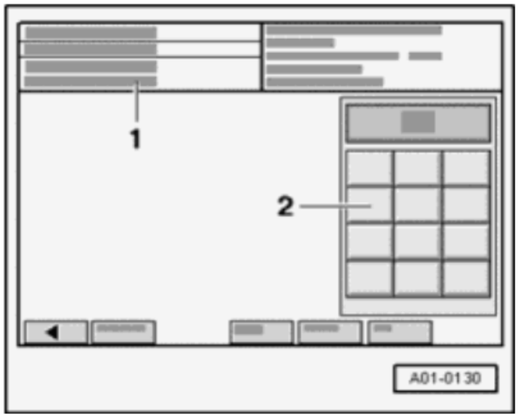

Fig. 364: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "004" for "display group number 004" in zone -2- and confirm entry by pressing -Q- button.

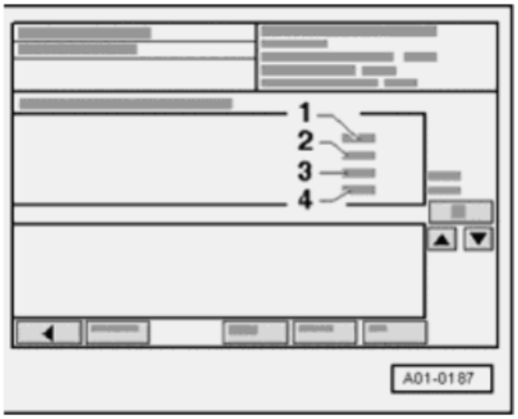

Fig. 365: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -4-.

	Display zones			
	1	2	3	4
Display group 004: Intake air temperature with engine idling				
Display	xxxx RPM	xx.x V	xxx.x°C	**xxx.x°C**
Display	Engine speed	Battery voltage	Coolant temperature	**Intake air temperature**
Range				**-48.0 to 143.0°C**
Specif. value	xxxx RPM	12.0 to 15.0 V	80.0 to 110.0°C	**Between ambient temperature and up to 110°C 1)**

1) If a temperature is displayed which deviates greatly from the ambient temperature of the sensor, check sensor and sensor wiring for terminal resistances and open circuit.

- Exit function "08 - Read measured value block" by pressing <-- button.

Checking wiring

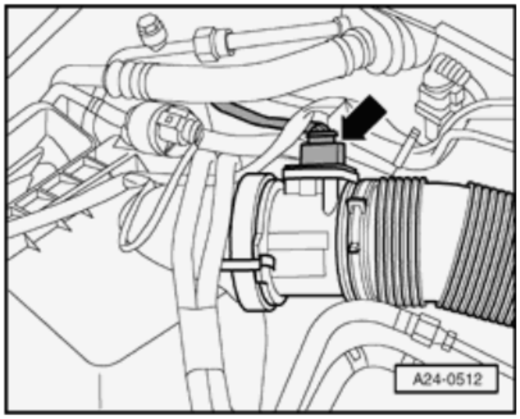

Fig. 366: Disconnecting Connector To Mass Air Flow (MAF) Sensor
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector (arrow) to mass air flow sensor.
- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

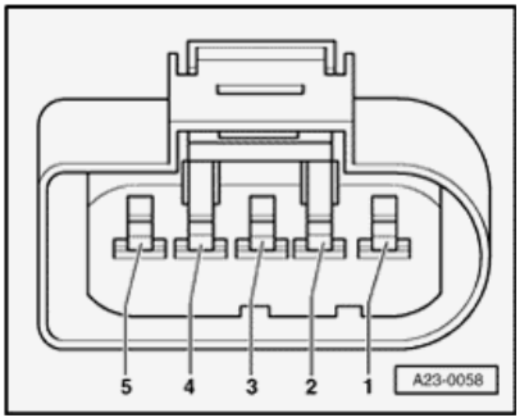

Fig. 367: Identifying 5-Pin Electrical Harness Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or ground in following wiring connection:

Connector Terminal	Test box VAG1598/31 Socket
5	26

- Repair any open/short circuit as necessary.
- Check all wires for short to one another.

If no wiring malfunction is detected:

- Replace Mass Air Flow (MAF) sensor -G70-.

Engine Coolant Temperature (ECT) sensor -G62-, checking

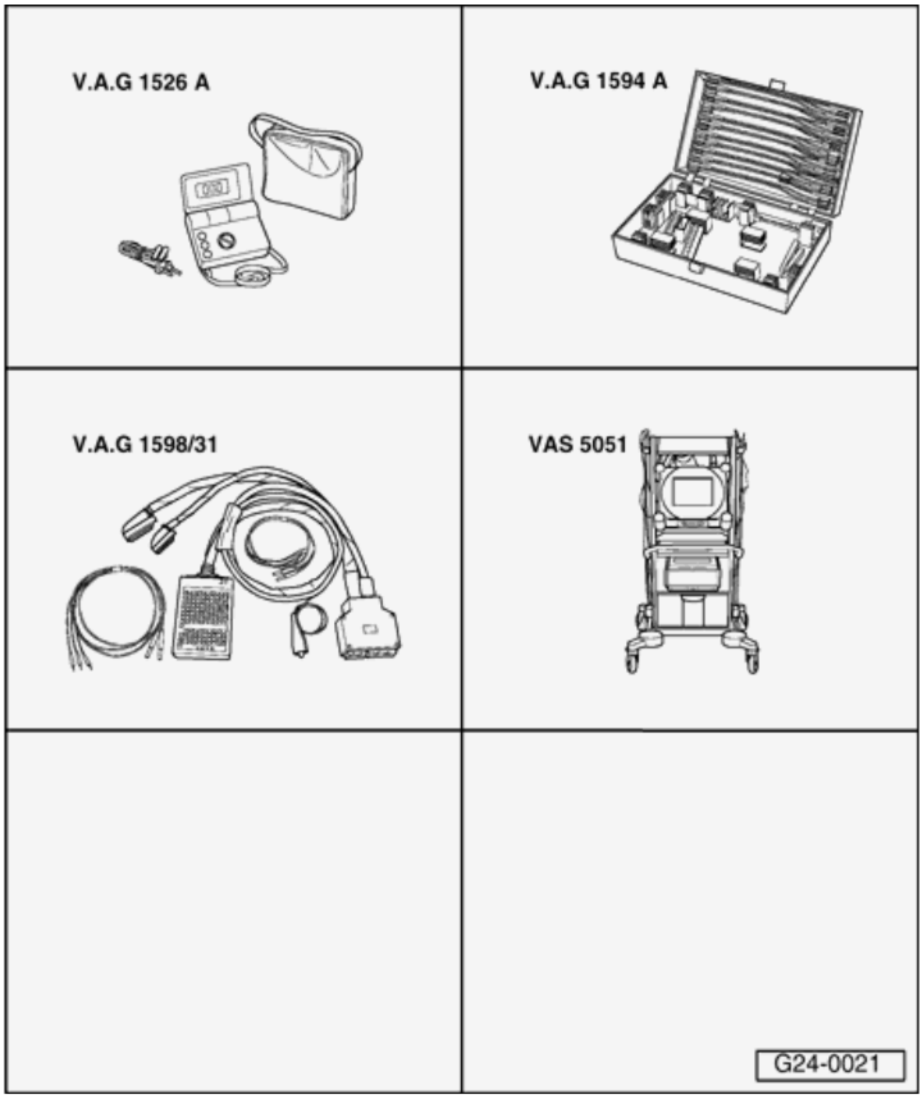

Fig. 368: Identifying Special Tools - Engine Coolant Temperature (ECT) Sensor -G62-, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

Installation location. Refer to **Component locations, overview**

Test requirements:

- Engine cold

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

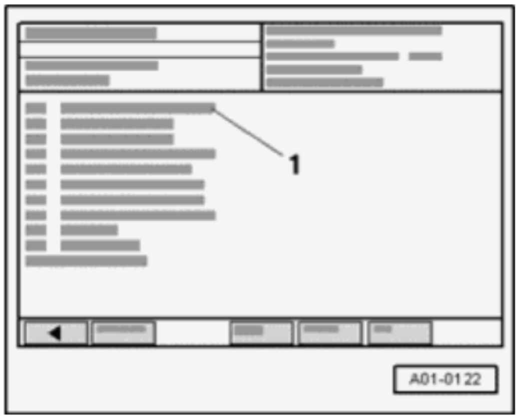

Fig. 369: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

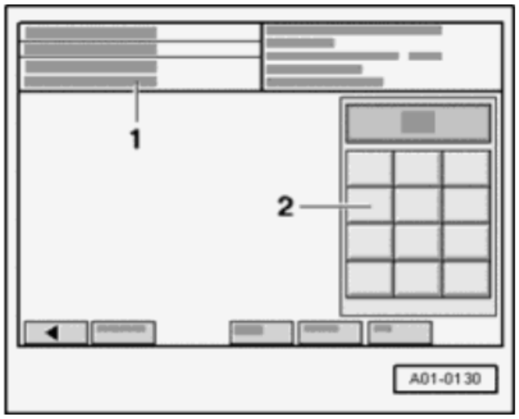

Fig. 370: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "004" for "display group number 004" in zone -2- and confirm entry by pressing -Q- button.

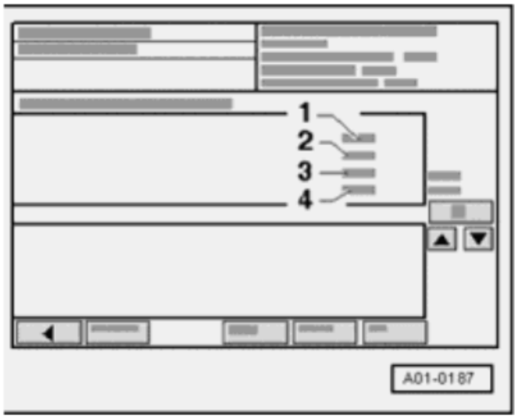

Fig. 371: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display field -3-.

	Display zones			
	1	2	3	4
Display group 004: Coolant temperature with engine idling				
Display	xxxx RPM	xx.x V	**xxx.x°C**	xxx.x°C
Display	Engine speed	Battery voltage	**Coolant temperature**	Intake air temperature
Range			**-48.0 to 143.0°C**	
Specif. value	xxxx RPM	12.0 to 15.0 V	**The temperature reading should increase evenly**	from ambient temperature up to 110°C

If display zone 3 shows an implausible value:

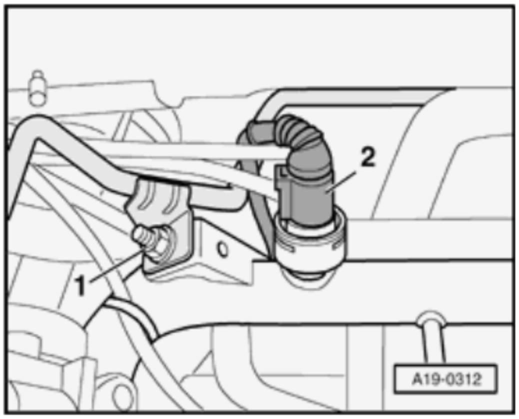

Fig. 372: Disconnecting Electrical Harness Connector At Engine Coolant Temperature (ECT) Sensor -G2-/-G62-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connector -2- at Engine Coolant Temperature (ECT) sensor -G2-/-G62-.

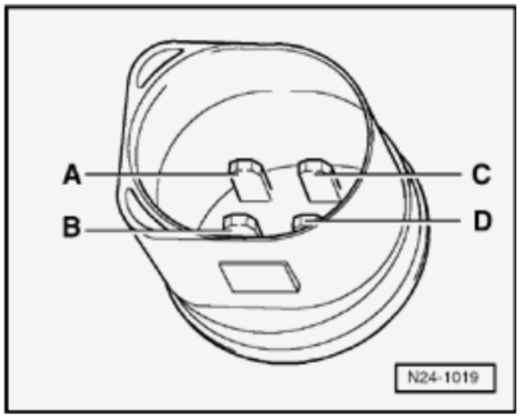

Fig. 373: Engine Coolant Temperature Sensor G62 Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter between terminals C and D of sensor to measure resistance.

Range A shows resistance values for temperature range 0 to 50°C and range B shows the values for temperature range 50 to 100°C.

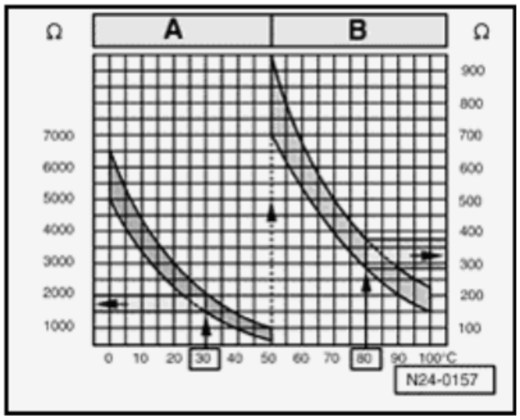

Fig. 374: Resistance Values Graph
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Sample readings:

- 30°C corresponds to a resistance of 1500 to 2000 ohms
- 80°C corresponds to a resistance of 275 to 375 ohms

If specified value is not attained:

- Replace engine coolant temperature sensor.

If specified value is attained:

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.

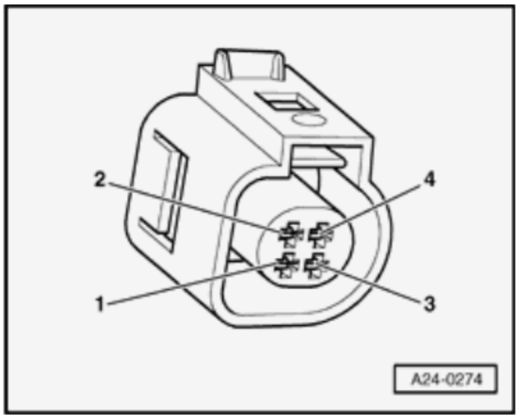

Fig. 375: Coolant Temperature Sensor Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Check for open circuit and short to positive or ground in following wiring connections:

Connector Terminal	Test box VAG1598/31 Socket
3	108
4 (signal)	93

- Test for short circuits between two wires.
- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace engine control module. Refer to **Engine Control Module (ECM) (without metal anti-theft housing), replacing**.

Engine Control Module (ECM) power supply, checking

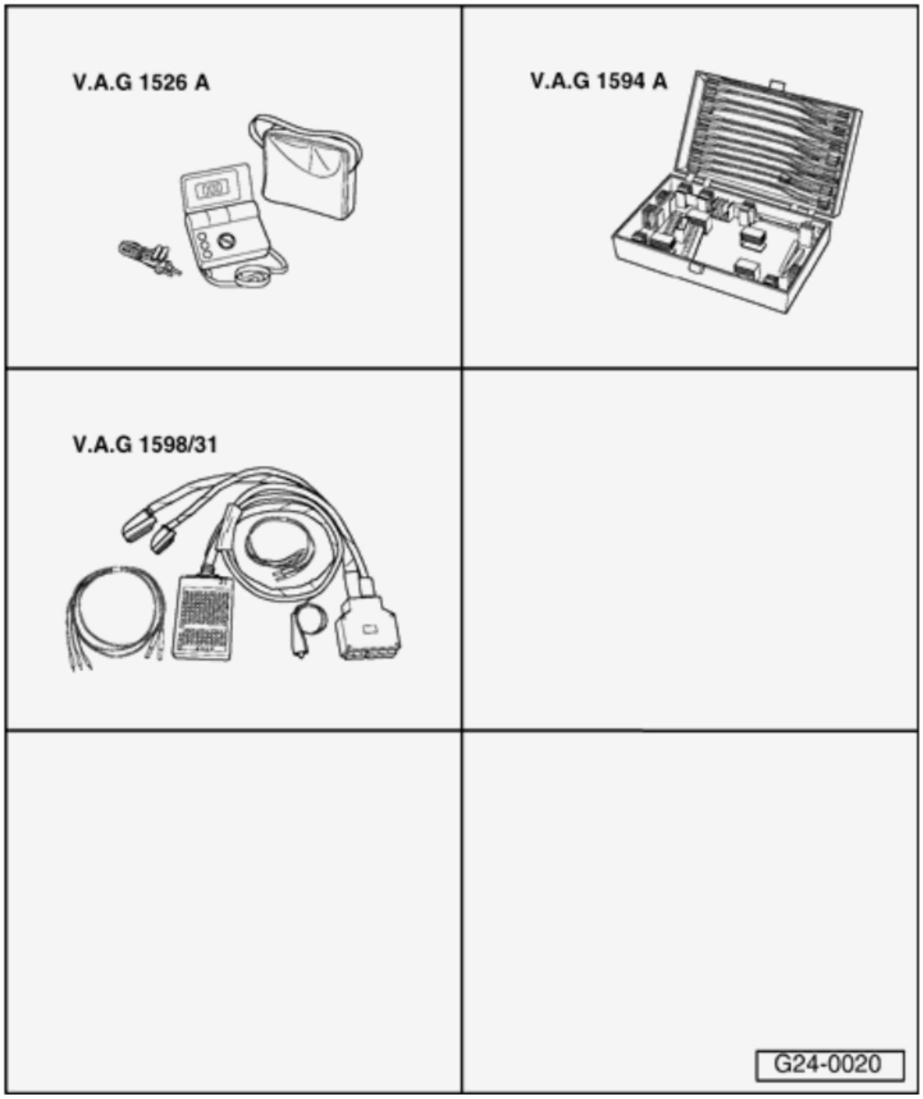

Fig. 376: Identifying Special Tools - Engine Control Module (ECM) Power Supply, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31

Test requirements

- Fuses for engine electronics OK

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Battery voltage at least 12.7 V

- Alternator OK

Test sequence

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Switch ignition on.

NOTE:

- **The positive voltage supply to the engine control module is provided via terminal 3 (terminal 15) and terminal 62 (terminal 30).**
- **The ground connection to the engine control module is provided via terminal 1 and terminal 2.**

- Connect multimeter as follows to measure voltage:

Test box VAG1598/31 Socket	Measure to
1	Battery positive
2	Battery positive
62	Engine ground

- Specified value: approx. battery voltage

- Connect multimeter as follows to measure voltage:

Test box VAG1598/31 Socket	Measure to
3	Engine ground

- Switch ignition on.

- Specified value: approx. battery voltage

If the specified values are not obtained:

- Check wiring connections.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Connect multimeter as follows to measure voltage:

Test box VAG1598/31 Socket	Measure to
121 1)	Engine ground

1) The Motronic Engine Control Module (ECM) power supply relay -J271- carries voltage on terminal 121 of engine control modules after switching off the ignition for up to 15 minutes.

- Switch ignition on.

- Specified value: approx. battery voltage

If specified value is not attained:

- Check wiring connections.

Refer to Electrical Wiring Diagrams, Troubleshooting & Component Locations

- Check Motronic Engine Control Module (ECM) power supply relay -J271-. Refer to **Motronic Engine Control Module (ECM) power supply relay -J271-, checking**.

Knock control stop, checking

If a malfunction entry relating to "knock control stop reached" is made, perform the following checks:

Special tools and equipment

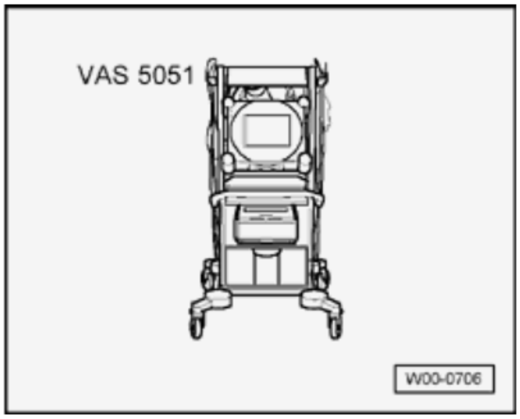

Fig. 377: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

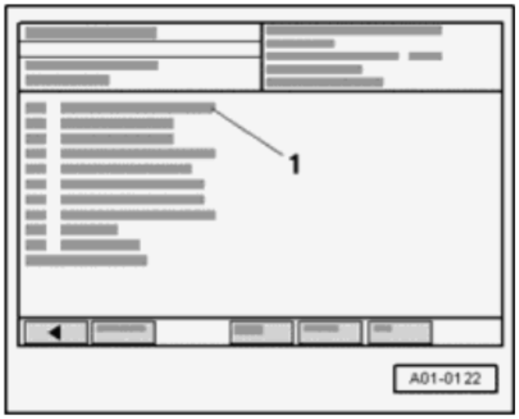

Fig. 378: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Under -1- select diagnostic function "08 - Read measured value block".

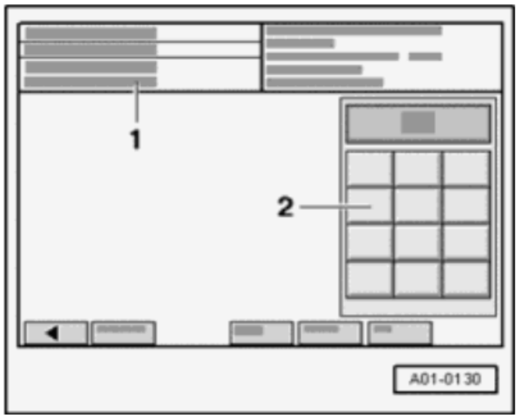

Fig. 379: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group max. input value = 255

- Enter "020" for "display group number 020" in zone -2- and confirm entry by pressing -Q- button.

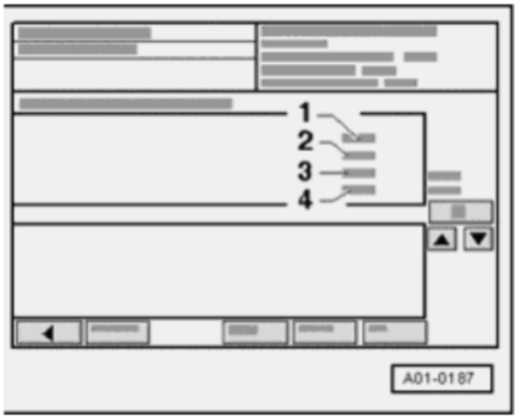

Fig. 380: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display fields -1- to -4-.

	Display zones			
	1	2	3	4
Display group 020: Ignition knock control during driving				
Display	**xx.x°CA**	**xx.x°CA**	**xx.x°CA**	**xx.x°CA**
Display	**Ignition angle retardation cylinder 1 through Knock control**	**Ignition angle retardation cylinder 2 through Knock control**	**Ignition angle retardation cylinder 3 through Knock control**	**Ignition angle retardation cylinder 4 through Knock control**
Specif. value	**0 to 12°CA**	**0 to 12°CA**	**0 to 12°CA**	**0 to 12°CA**
Note:	Evaluation. Refer to **Evaluation of ignition angle retardation**			

NOTE: The numbers displayed in display zones 1 to 4 represent the actual ignition timing retardation due to the knock control of the individual cylinders. The ignition angle retardation is carried out late in °CA (crankshaft degrees).

- To change to display group 021, press s button.

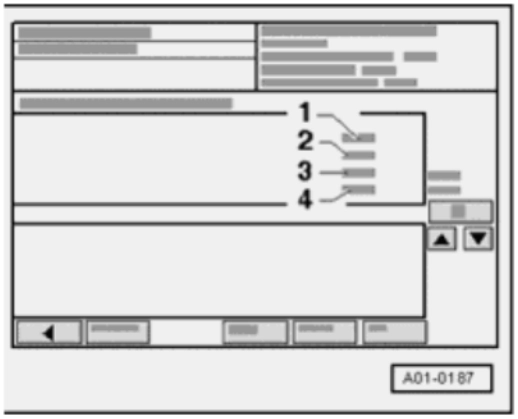

Fig. 381: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display fields -1- and -2-.

	Display zones			
	1	2	3	4
Display Group 021: Ignition knock control during driving				
Display	**xx.x°CA**	**xx.x°CA**		
Display	**Ignition angle retardation cylinder 5 through Knock control**	**Ignition angle retardation cylinder 6 through Knock control**		
Specif. value	**0...12°CA**	**0...12°CA**		
Note:	Evaluation. Refer to **Evaluation of ignition angle retardation**			

NOTE: **The numbers displayed in display zones 1 and 2 represent the actual ignition timing retardation due to the knock control of the individual cylinders. The ignition angle retardation is carried out late in °CA (crankshaft degrees).**

- Exit function "08 - Read measured value block" by pressing <-- button.

Evaluation of ignition angle retardation

Indicated on display	Possible causes of malfunction	Corrective action
All cylinders greater than 12°CA	- Knock sensor faulty	- Check knock sensor. Refer to **Knock sensors, checking**
	- Connector corroded	
	- Knock sensor incorrectly tightened	- Loosen knock sensor and tighten to 20 Nm.

	• Loose components on engine	○ Secure components
	• Poor fuel quality	○ Change fuel quality (see operating instructions)
One cylinder deviates significantly from the others	• Connector corroded	○ Check knock sensor. Refer to **Knock sensors, checking**
	• Engine malfunction	○ Check compression: Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**
	• Loose components on engine	○ Secure components

Knock sensors, checking

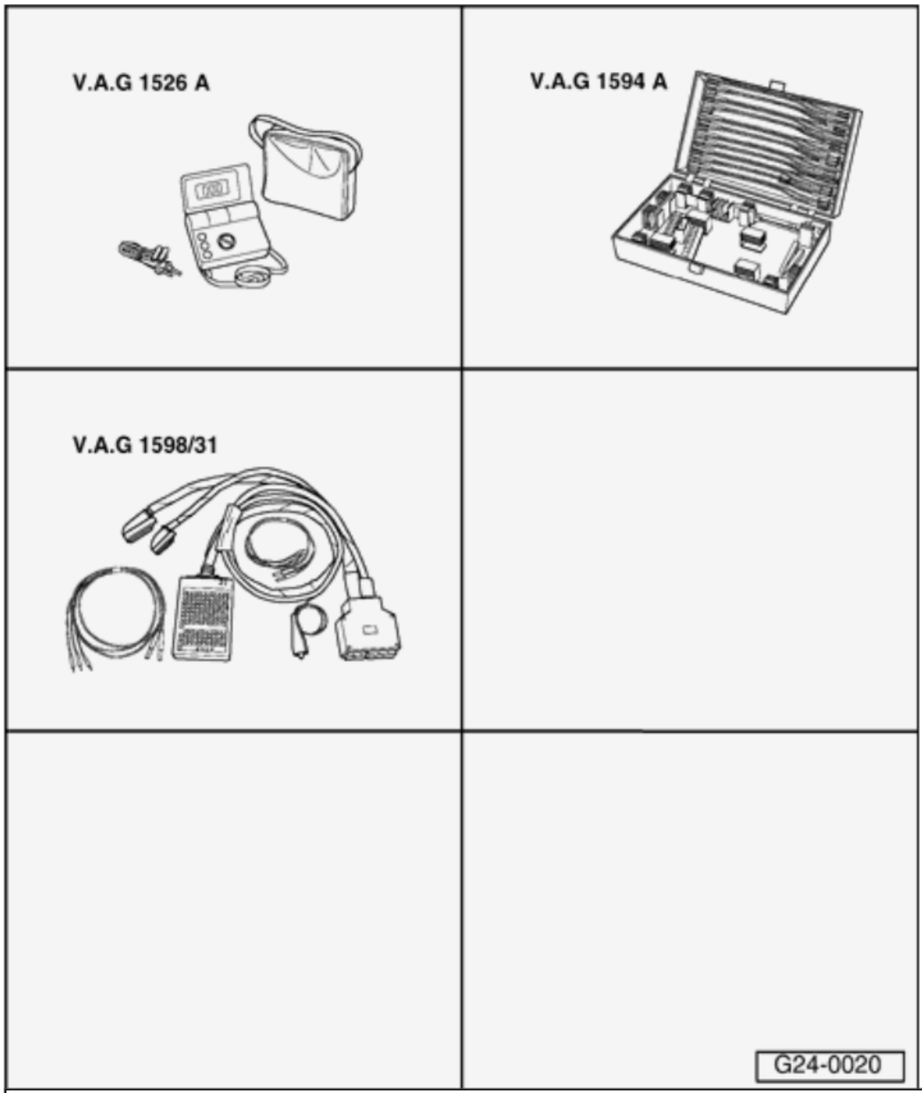

Fig. 382: Identifying Special Tools - Knock Sensors, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1594 A
- VAG1598/31

NOTE:

- **The Knock Sensor (KS) 1 -G61- and Engine Coolant Temperature (ECT) sensor -G62- cannot be tested by themselves electrically.**
- **Use only gold-plated terminals when repairing the cable connectors for the knock sensors.**
- **Make sure that the knock sensors function properly it is important to keep to the specified tightening torque of 20 Nm.**
- **Check connector between knock sensor and wiring harness for corrosion.**

Testing knock sensor wiring

- Disconnect connector of relevant knock sensor. See **Fig. 101** or **Fig. 102**.

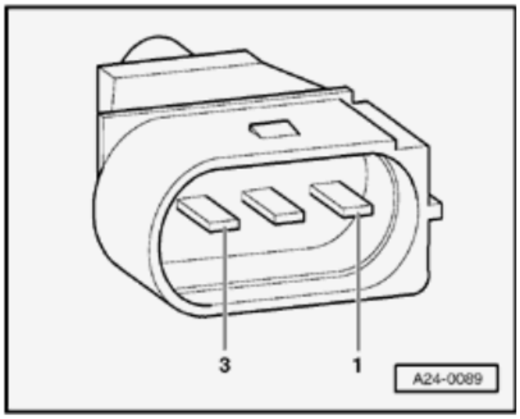

Fig. 383: 3-Pin Connector & Terminals
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Test for short between all three terminals in knock sensor connector (terminals 1+2, 1+3, 2+3).

- Specified value: infinity ohms (no continuity) - the wires must not be connected to each other.

- If there is a connection between terminals, install a new knock sensor.

If no malfunction is found:

Checking wiring from knock sensors to engine control module

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Check for open circuit and short to ground/positive or ground in following wiring connections:

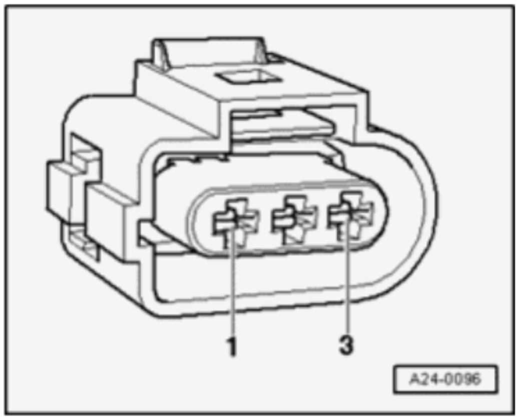

Fig. 384: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Knock Sensor (KS) 1 -G61- (Bank 1)

Connector Terminal	Test box VAG1598/31 Socket
1 (signal)	106
2 (ground)	99
3 (screening)	108

- Knock Sensor (KS) 2 -G66- (Bank 2)

Connector Terminal	Test box VAG1598/31 Socket
1 (signal)	107
2 (ground)	99
3 (screening)	108

- Repair any open/short circuit as necessary.

Camshaft Position (CMP) sensor, checking

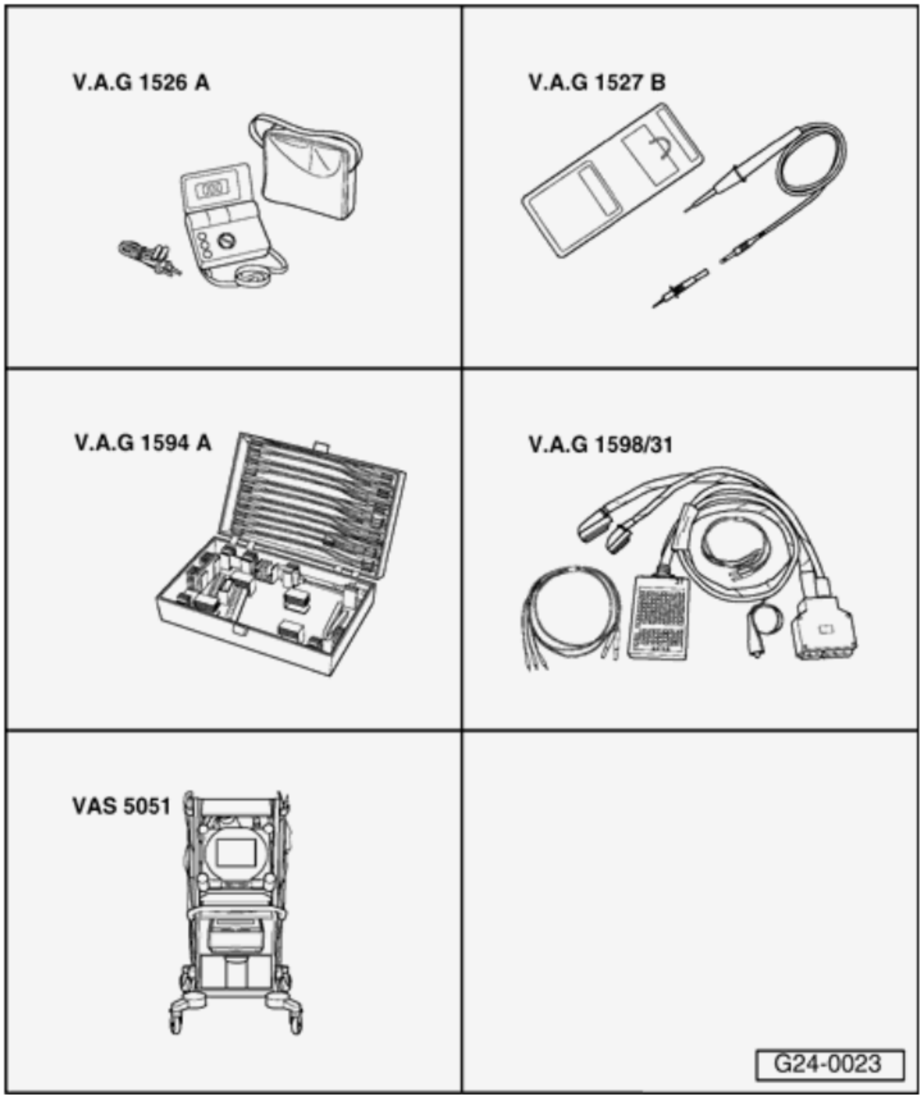

Fig. 385: Identifying Special Tools - Camshaft Position (CMP) Sensor, Checking
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Special tools and equipment

- VAG1526 A
- VAG1527 B
- VAG1594 A
- VAG1598/31

- VAS5051 with VAS5051/1

Installation location. Refer to **Component locations, overview**

NOTE:

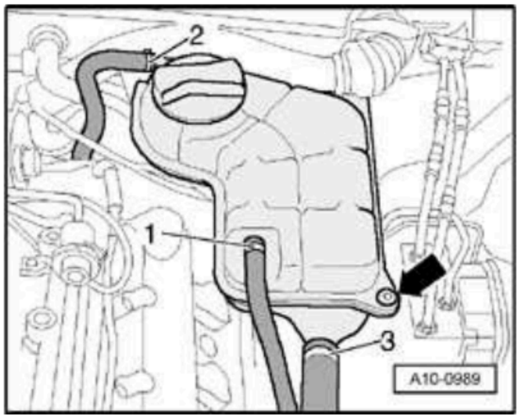

Fig. 386: Removing Coolant Hoses
Courtesy of VOLKSWAGEN UNITED STATES, INC.

To gain access to the connectors on cylinder bank 2 (left), you must remove the cover on left of engine compartment, disconnect cable to coolant shortage indicator switch at bottom of expansion tank, remove screw (arrow) for coolant expansion tank and lay aside. Coolant hoses -1 to 3- do not have to be disconnected.

Checking actuation

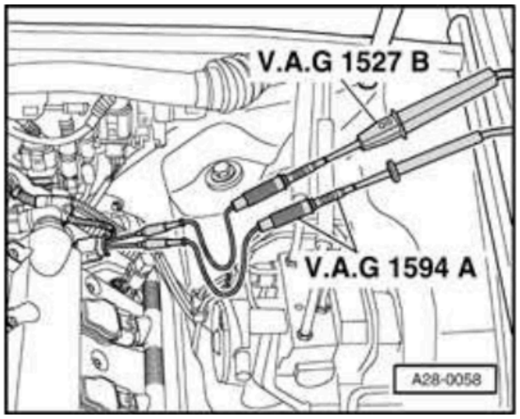

Fig. 387: Connecting Voltage Tester VAG1527 B With Measuring Probes And Plug-In Adapters From VAG1594 A Between Terminal 2 (CMP Sensor Signal) And Terminal 1 (Positive)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect voltage tester VAG1527 B with measuring probes and plug-in adapters from VAG1594 A between terminal 2 (CMP sensor signal) and terminal 1 (positive); connector remains plugged in.

NOTE: Receptacles are numbered accordingly on the back of the connector.

- Operate starter for a few seconds.

- LED should flash.

NOTE: **Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control module (rather than extinguishing completely) and become much brighter when actuated.**

If LED does not flash:

Checking power supply

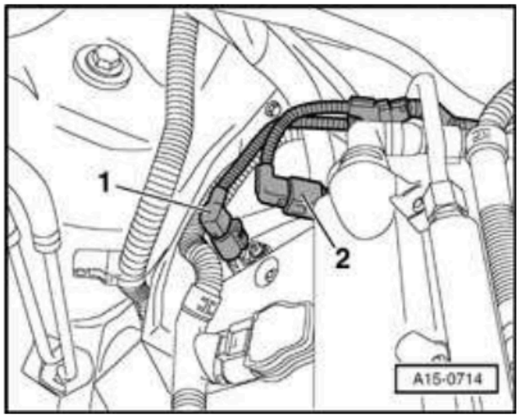

Fig. 388: Disconnecting Electrical Harness Connectors At Camshaft Position (CMP) Sensor -G40- And Camshaft Position (CMP) Sensor 3 -G300-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors -1- and -2- on Camshaft Position (CMP) sensor -G40- and Camshaft Position (CMP) sensor 3 -G300-.

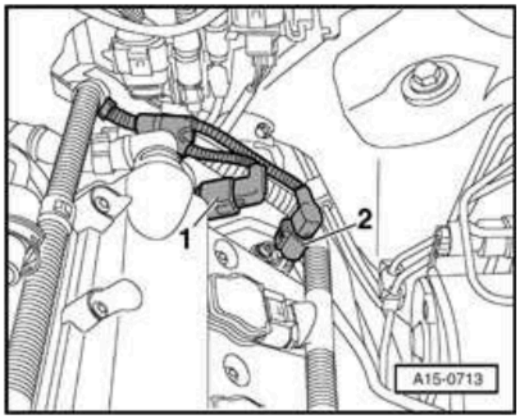

Fig. 389: Disconnecting Electrical Harness Connectors And At Camshaft Position (CMP) Sensor 2 -G163- And Camshaft Position (CMP) Sensor 4 -G301-
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Disconnect connectors -1- and -2- on Camshaft Position (CMP) sensor 2 -G163- and Camshaft Position (CMP) sensor 4 -G301-.

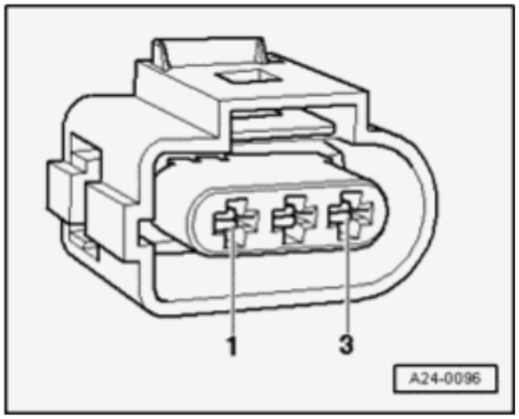

Fig. 390: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Measure to
1	Engine Ground

- Switch ignition on.

- Specified value: approx. 5 V

Checking signal wire

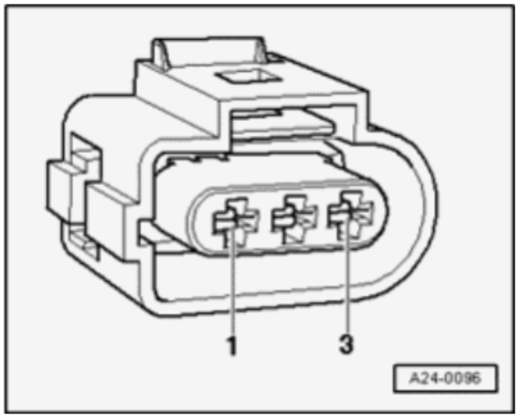

Fig. 391: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Measure to
2	Engine ground

- Switch ignition on.

- Specified value: approx. battery voltage

Checking ground wire

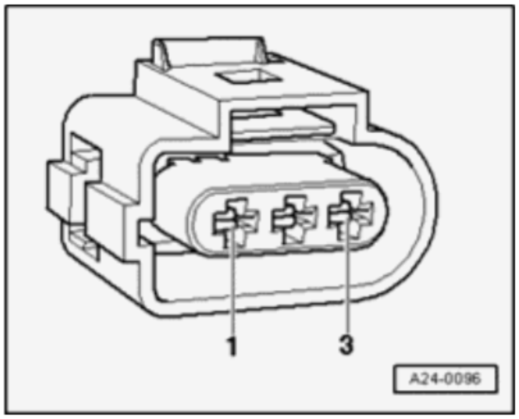

Fig. 392: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Connect multimeter as follows to measure voltage:

Connector Terminal	Measure to
3	Battery positive

- Specified value: approx. 10 V

- Repair any open/short circuit as necessary.

If the specified values are all achieved and the LED test light does not flash (measured between terminals 1 and 2 with starter connector attached),

- Install a new CMP sensor.

If the specified values are not obtained:

Checking wiring between CMP sensor and engine control module.

- Connect test box VAG1598/31 to wiring harness for engine control module; do not connect engine control module. Refer to **Wiring and component check with test box VAG 1598/31**.
- Check for open circuit and short to positive or ground in following wiring connections:

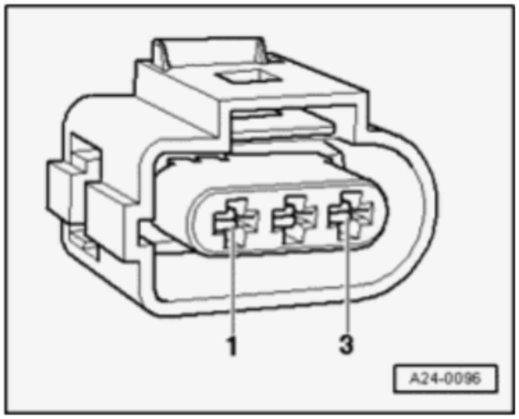

Fig. 393: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft Position (CMP) sensor -G40- (Bank 1)

Connector Terminal	Test box VAG1598/31 Socket
1 (positive)	98
2 (signal)	87
3 (ground)	108

- Camshaft Position (CMP) sensor 2 -G163- (Bank 2)

Connector Terminal	Test box VAG1598/31 Socket
1 (positive)	98
2 (signal)	86
3 (ground)	108

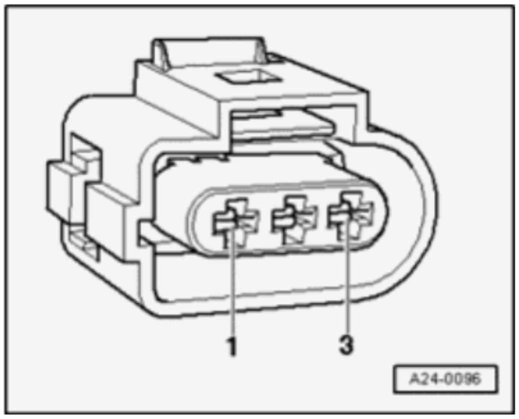

Fig. 394: Identifying 3-Pin Connector Terminals 1 & 3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Camshaft Position (CMP) sensor 3 -G300- (Bank 1)

Connector Terminal	Test box VAG 1598/31 Socket
1 (positive)	98
2 (signal)	81
3 (ground)	108

- Camshaft Position (CMP) sensor 4 -G301- (Bank 2)

Connector Terminal	Test box VAG 1598/31 Socket
1 (positive)	98
2 (signal)	54
3 (ground)	108

  - Repair any open/short circuit as necessary.

Check phase position of CMP sensor

  - Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

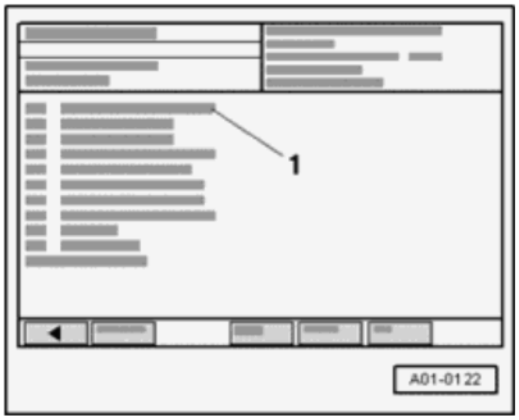

Fig. 395: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

  - Under -1- select diagnostic function "08 - Read measured value block".

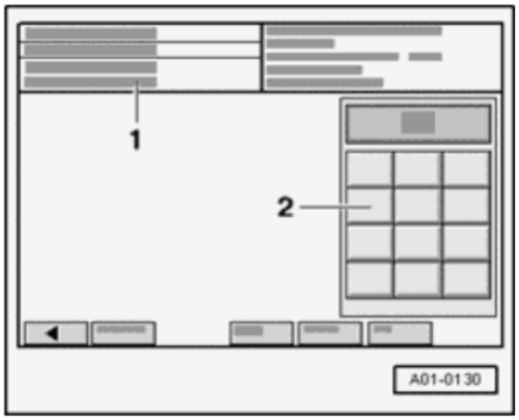

Fig. 396: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

1 - Enter display group

- Enter "093" for "display group number 093" in zone -2- and confirm entry by pressing -Q- button.

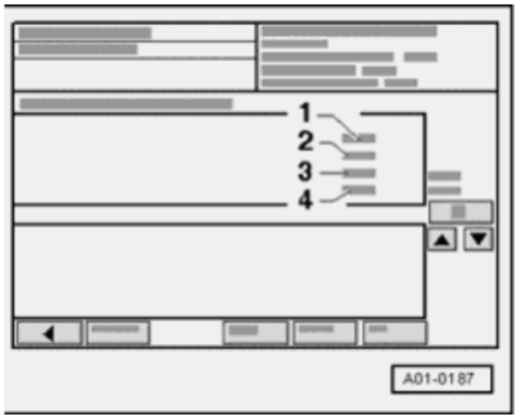

Fig. 397: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display fields -1- to -4-.

	Display zones			
	1	2	3	4
Display group 093: Phase locations of CMP sensors (bank 1 and bank 2), engine idling				
Display	**° CA**	**° CA**	**° CA**	**° CA**
Display	**Phase location, intake bank 1**	**Phase location, intake bank 2**	**Phase location, exhaust bank 1**	**Phase location, exhaust bank 2**
Specif. value	**-20...32°CA**	**-20...32°CA**	**-20...32°CA**	**-20...32°CA**

Note:	**If the specified values are exceeded significantly in the two CMP sensors of one cylinder bank, the connectors for the CMP sensors of that cylinder bank are interchanged.** **If the specified values for one CMP sensor are exceeded, check CMP sensor and camshaft adjustment.** . Refer to **15 ENGINE - CYLINDER HEAD, VALVETRAIN**

- Exit function "08 - Read measured value block" by pressing <-- button.

Misfire detection, checking

Special tools and equipment

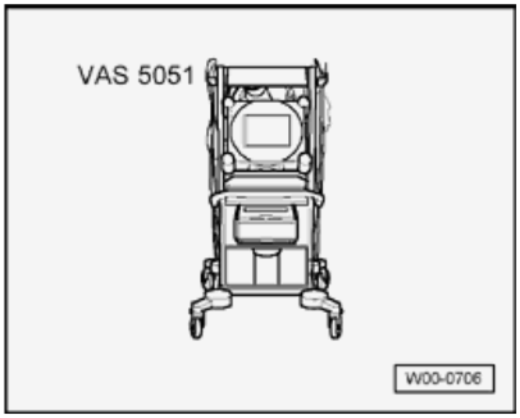

Fig. 398: Identifying Vehicle Diagnosis, Testing And Information System VAS 5051
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- VAS5051 with VAS5051/1

Test sequence

- Connect testing and information system VAS5051. Refer to **Vehicle diagnostic, testing and information system VAS5051, connecting and select functions** and select vehicle system "01 - Engine electronics" in selection. Engine must be running at idling speed.

Rapid data transfer HELP Select function XX

Indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08 and press Q button to confirm input.

Read Measuring Value Block Q Input display group number XXX

Indicated on display:

- Press buttons -0-, -1- and -4- to input "display group number 14" and press Q button to confirm input.

```
Read Measuring Value Block 14 -->
1 2 3 4
```

Indicated on display:

- Check misfire detection.

	Display zones			
	1	2	3	4
Display group 014: Misfire detection				
Display	xxx RPM	xxx%	**xxx**	**---**
Display	Engine speed	Load	**Total misfires**	**Misfire detection**
Range	min.: 550 RPM max.: 7200 RPM	min.: 0 max.: 100		**Activated** **not activated**
Specif. value	600 to 820 RPM	xx.x%	**0 to 5**	**Activated**
Note:	---	---	If the specified value is not reached: Evaluation display field 3. Refer to **Evaluating display groups 014, 015 and 016, Display field 3:**.	---

If the specified value is reached:

- Press --> button.

```
Rapid data transfer HELP
Select function XX
```

Indicated on display (function selection):

If specified value is not attained:

- To change to display group 015, press s button.

Checking misfire recognition of the individual cylinder

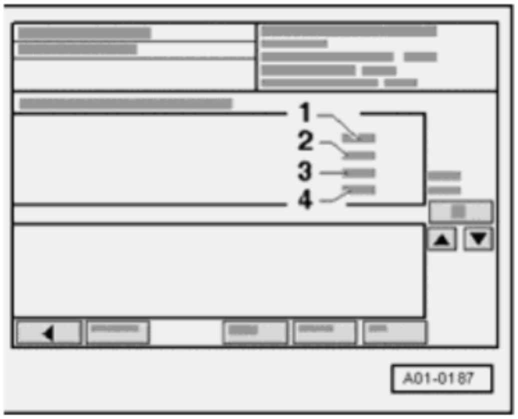

Fig. 399: Diagnostic System VAS 5051: Display
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display fields -1- to -4-.

	Display zones			
	1	2	3	4
Display group 015: Misfire detection of cylinders 1, 2 and 3				
Display	**xxx**	**xxx**	**xxx**	**---**
Display	**Number of misfires in cylinder 1**	**Number of misfires in cylinder 2**	**Number of misfires in cylinder 3**	**Misfire detection**
Range				**Activated** **Blocked**
Specif. value	**0**	**0**	**0**	**Activated**
Note:	If nominal value is exceeded: Evaluation. Refer to **Evaluating display groups 014, 015 and 016, Display field 3:**			**---**

- To change to display group 016, press s button.

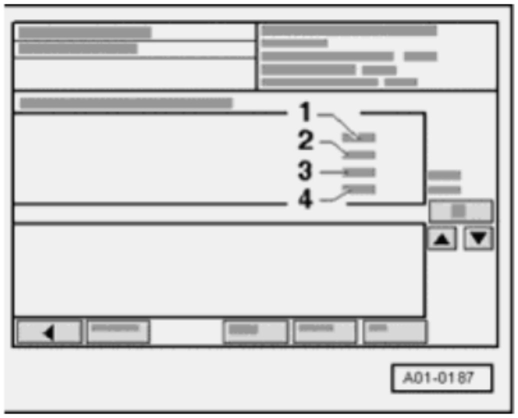

Fig. 400: Diagnostic System VAS 5051: Display

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Display on VAS5051:

- Check indication in display fields -1- to -4-.

	Display zones			
	1	2	3	4
Display group 016: Misfire detection of cylinders 4, 5 and 6				
Display	**xxx**	**xxx**	**xxx**	**---**
Display	**Number of misfires in cylinder 4**	**Number of misfires in cylinder 5**	**Number of misfires in cylinder 6**	**Misfire detection**
Range				**Activated** **Blocked**
Specif. value	**0**	**0**	**0**	**Activated**
Note:	If nominal value is exceeded: Evaluation. Refer to **Evaluating display groups 014, 015 and 016, Display field 3:**			**---**

- Exit function "08 - Read measured value block" by pressing <-- button.

Evaluating display groups 014, 015 and 016, Display field 3:

Display field: 3	**Possible cause**	**Corrective action**
Greater than 5	• Spark plug faulty • Spark plug connector faulty • Ignition coil or power output stage	○ Check spark plugs and ignition wires with connector ○ Check ignition coils with output stages. Refer to **Ignition coils with output stages, checking**.
	• Fuel injector faulty	○ Check fuel injectors. Refer to **Fuel injectors, checking**.
	• Crankshaft housing leaking	○ Check hose setup of crankcase ventilation for secure seating and for proper seal
	• Check compression	